

PCComputing

AMERICA'S COMPUTING MAGAZINE

386 Breakthrough
High Power, Low Price

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Which Board to Buy

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- Dual diskette and hard disk drive controller.
- Enhanced 101-key keyboard.
- 1 parallel and 2 serial ports.
- 200 watt power supply.
- Real-time clock.
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 - 8 MHz Intel 80287 coprocessor.
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- Real-time clock.
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- Socket for 80287 coprocessor.

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System 220	With Monitor		
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the computer
industry.



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—PC MAGAZINE

"...the System 220 has more going for it than just speed."

—PC WORLD

"...includes a year's on-site support...in the price of the computer. This is the sweetest support deal offered by any computer vendor in the industry."

—ERIC KNORR, PC WORLD

"The hot item from a technical point of view is the System 220. This machine runs a 286 processor at 20 MHz, which is its major claim to fame."

—WILL FASTIE, PC WEEK

"...the Dell machine is renewed evidence that the price of 286-based desktop equipment continues to drop rapidly, making such machines very attractive for daily work under MS-DOS even as they hold out the promise of running OS/2 in the future."

—WILL FASTIE, PC WEEK

The reviews are beginning to pour in. And they read like a wish list for every power user looking to exceed the ordinary limitations of a 286 personal computer.

The computer everyone is praising in such glowing terms is the Dell System 220.

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File: C:\AGENDA\FILES\ISSUES			
View: Issues by Person			
Issues	Joan	Priority	When
• Research	• Decision needed on research budget by end of this week-- discuss options with Jim and Joan.	• High	• 06/25/88
• Competitive Tracking	• Forward product comparison articles to Joan.	• Low	• 07/07/88
Issues	Bob	Priority	When
• Distribution	• Do Tom and Bob think we need to adjust distribution mix?	• High	• 06/22/88
• Bonus Dollars	• Bob will present ten-point incentives program at sales conference	• Medium	• 06/29/88

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File View Item Category Print Utility System Quit		
New, Remove, Position, Assign, Discard, Undiscard		
Scratchpad	Who	Issues
• Forward product comparison articles to Joan.	• Joan	• Competitive Tracking
• Can we get the cost of goods sold under \$12?	• Tom	• Materials
• Bob will present ten-point incentives program at sales conference.	• Bob	• Bonus Dollars
• Tom will have his report in by a week from Friday, make sure it covers pricing, strategy, distribution, and implications of using outside vendor for typesetting and printing.	• Tom	• Distribution Vendors Pricing
• Decision needed on research budget by end of this week-- discuss options with Jim and Joan.	• Jim Joan	• Research

Enter items of information manually, import them electronically, or use the pop-up capability while in another program.

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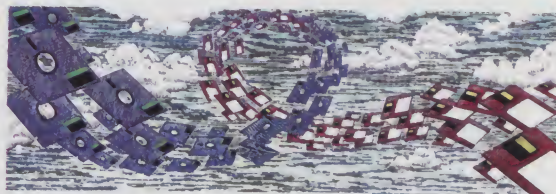


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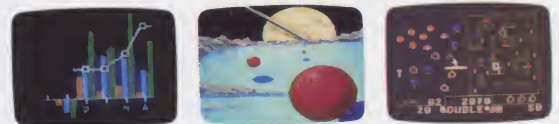
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PERSPECTIVE

Five years ago, it was so simple. Messages and mail appeared in a 9-by-12 tray marked "In" on the corner of my desk. The mail arrived at predictable times, and I went through it quickly: looked at each piece, decided whether it deserved tossing or reading, and acted. A glance told me how much mail I had and which items were high priority.

Then we got voice mail, and life got complicated. Colleagues the world over fired off messages to me day and night, confident I'd get them within half a day. The problem was that I had to sit still through all those messages.

I think of my paper mail as a random-access medium: I can go directly to the important things. But voice mail is like TV news: you have to sit through all the fires and robberies to get to the good stuff. Voice mail brought with it another in-box—and one that was much less efficient to manage.

Then came electronic mail. I adopted it in two flavors: MCI, for communicating with the outside world, and a mini-computer-based system, for sending messages around the office. Now my in-box count was up to four, and people were sending me not only messages but also spreadsheets, graphics, and even formatted documents, ready to print.

Fortunately, new front-end software started taking some of the pain out of e-mail. Still, with four in-boxes to check, the chances I could be reached reliably began to diminish, too.



Then, my workgroup began to use network-based mail and conferencing, and I had yet another in-box. Just getting a catalog of my mail—paper, voice, electronic, network—could take half an hour.

Now there's a new source of "mail," and it's catching on faster than any of the others did. At least twice a day, someone calls and asks me to "check the fax," and five or six other facsimile messages arrive unannounced.

When you think about it, the fax explosion could have been predicted. As Frank Bican and Winn Rosch point out in this issue, fax requires trivial effort on the part of both sender and receiver. What's more, PCs team up with fax to push its abilities even further.

Without thinking about it, though, I've acquired another in-box. How long can I be counted on to check all those boxes on a regular basis?

As we're thinking about zippier ways to communicate, we also need to think about ways to reduce the burden of our in-boxes. Riches will go, I expect, to those who combine the power of multiple communications media with the electronic equivalent of that single wooden 9-by-12 tray on my desk.

MICHAEL E. KOLOWICH
Publisher

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However, we can't look up information not at hand, recommend products, or diagnose your computer problems over the phone.

If you buy a product advertised in *PC/Computing*, are dissatisfied, and can't resolve the problem, write (but do not call) Janice Watts, Marketing Department, at 80 Blanchard Rd., Burlington, MA 01803. Include all copies of correspondence.

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Write *PC/Computing*, P.O. Box 58229, Boulder, CO 80321-8229. Subscription service: 303/447-9330. Subscription rate is \$19.94 for one year (12 issues). Additional postage for Canada and all foreign is \$10.00/year. Application to mail at second-class postage rate is pending at New York, NY. POSTMASTER: Send address changes to *PC/Computing*, P.O. Box 58229, Boulder, CO 80321-8229.

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PC/Computing serves its advertisers from six offices throughout the United States. Names, addresses, and telephone numbers of each representative accompany the Advertiser Index in this issue.

PC/Computing (ISSN 0899-1847) is published monthly by Ziff-Davis Publishing Co., a division of Ziff Communications Co., One Park Avenue, New York, NY 10016.

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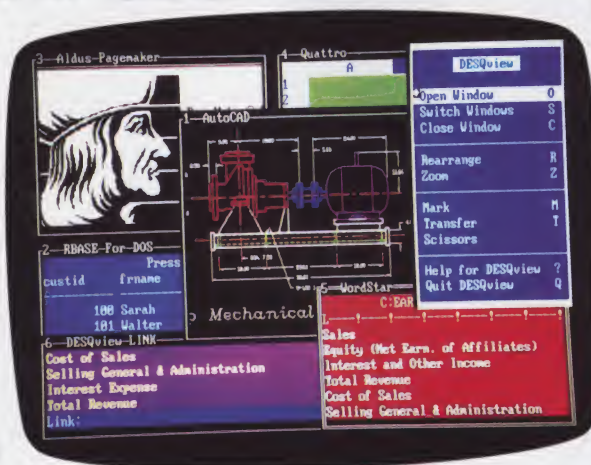
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Best of all, DESQview accomplishes all this with a substantial speed advantage over any alternative environment.

Multitask beyond 640K.

When you want to use several programs together, you don't have to leave your current program. Just open the next program. View your programs in windows or



For programmers, DESQview's API, with its strengths in inter-task communications and multitasking, brings a quick and easy way to adapt to the future. With the API's mailboxes and shared programs, programmers are able to design programs running on DOS with capabilities like those of OS/2.

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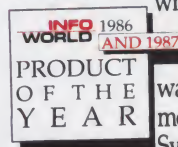
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Experts are voting for DESQview. And over a million users, too.

If all of this sounds like promises you've been hearing for future systems, then you can understand why over a million users have chosen DESQview. And why PC Magazine gave DESQview its Editor's Choice Award for "The Best Alternative to OS/2," why readers of InfoWorld twice voted DESQview "Product of the Year" why, by popular vote at



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Mr. Tom Trent
Boston Mechanics
3551 Alton Way
New York, NY 10017

Dear Tom:

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quality available.

You've noticed
we put together
Yes, thanks to Q&A
(ha,ha). But seriously
me write letters
we can spend more
better in person.

Thanks again
fine people at

Sincerely,

Roland Sanders
Roland Sanders
District Manager

P.S.

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Pappas
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& Greenwood

Ms. Alice Lansing
Tough-Guy Manufacturing
76543 Ralston Ave.
Keokuk, AK 99504

Dear Alice:

Just wanted to say
think you'll find the
quality available.

You've noticed
we put together
Yes, thanks to Q&A
(ha,ha). But seriously
me write letters
we can spend more
better in person.

Thanks again
fine people at

Sincerely,

Roland Sanders
Roland Sanders
District Manager

P.S.

Armstrong
Pappas
Nouaux
& Greenwood

Mr. Randy Tisdale
Associated Distributors
1101 Del Monte Ave.
San Pablo, CA 95432

Dear Randy:

Just wanted to say thanks for the 35 cases of sprockets you placed on
May 7th. I think you'll find the highest quality available.

You've noticed, I'm sure, that your service has improved since
we put together our new customer tracking and invoicing system.
Yes, thanks to Q&A software, your sprockets will always be in gear
(ha,ha). But seriously Randy, Q&A is really amazing. It even helps
me write letters like this. Now that computers do more work for us,
we can spend more time with you. I'm for that. My jokes are always
better in person.

Thank you and I appreciate the opportunity to serve all the
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Sincerely,

Roland Sanders
Roland Sanders
District Manager

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NORA

G E O R G A S

I

t's one of the hottest technologies of the year. But it doesn't have anything to do with high-speed microprocessors, better LCDs, or gallium arsenide. It's fax.

That's right: fax. The number of fax machines has grown from fewer than 20,000 at the beginning of the decade to more than a million today. It's estimated the ranks will swell by another million in the next year alone.

What's even more interesting is the boom in PC-to-fax systems. An inboard fax card can send information from a PC and spit it out at the other end in the form of a traditional fax. Suddenly the PC can do double duty as an interactive temple of glowing phosphors and a purveyor of good old-fashioned facsimiles. And a PC fax board bridges all kinds of compatibility problems. There's no need for sender and receiver both to have PCs. Or fax machines.

Sure, electronic mail is great for sending text, but lots of PC users don't have e-mail. They're bound to have one of those million fax machines sitting in the corner of the office, though. Fax is fast, relatively cheap, and a cinch to use. It quickly bridges the gap between PC users and those who aren't yet online, using technology that's already as familiar to the average office worker as a photocopier or typewriter.

In fact, fax may be all too familiar to some victims of fax junk mail—press releases and other materials that show up unsolicited in the tray of your fax machine because your fax number has been published in a national directory, or printed on your business card. It's the biggest electronic intrusion since junk mail started showing up in our MCI mailboxes, and it's every bit as annoying.

But it's no wonder everyone's into fax. The truth is that even in the electronic age, hard copy has a lot of power, a life of its own that blends words and pictures in a way we can't yet duplicate electronically.

That's why videotex hasn't gotten off the ground. Forget the argument that the difficulty of incorporating advertising into a videotex product rules out its economic viability—



though that's certainly a factor. The real reason is that you can't call up an online service and get a beautifully reproduced piece of four-color art that illustrates the story you're reading. Or a photograph or other faithful rendering of the gas grill you're buying from Sears.

That's why you're reading this column in a traditional printed magazine, not from a disk, or on a computer bulletin board.

Partly it's a question of standards. Despite all the hardware and software sophistication available to us today, we can't sit down at a PC and send a business chart through MCI Mail in a way the recipient can display without first going through an amazing number of contortions and conversions. Part of the success of fax comes from the worldwide adoption of standards that have eliminated incompatibility between machines.

Even if the standards were in place to allow easy, universally accessible melding of electronic text and graphics, hard copy still has some unbeatable advantages. You can take a fax with you, mark it up, show it to other people. You can't do that with a computer screen. People have a long-standing tactile and emotional response to the printed page that isn't easily abandoned. And shouldn't be.

Until we have a way for all PC users, no matter which computer software, phone company, or electronic mail service they use, to transmit and receive text and graphics in documents that can be easily read by all, fax is our best bet.

Maybe it's a little bit of retrotech creeping through, but we prefer to look at fax as modern technology confirming and bolstering a much older idea: the power of the printed page. ■

Nora Georgas

EDITOR

PHOTOGRAPH BY RUVEN AFANADOR



T1000
80C88
4.77MHz
720KB



T1200F
80C86
9.54MHz
720KB(x2)



T1200H
80C86
9.54MHz
720KB
20MB HDD

Obviously, We Believe In

When it comes to portable PCs, we think that numbers should speak for themselves.

Perhaps that's why we have the largest number of high-powered, highly-portable PCs on the market today. All of which are IBM-compatible. All of which have industry-standard 3½" disk drives, full function keyboards and a vast array of built-in ports. All squeezed into packages as easy to carry as a briefcase.

The T1000, for example, weighs a mere 6.4 pounds, yet boasts MS-DOS® in ROM, a 720KB 3½" disk drive and an optional 768KB memory card which can be configured as

EMS memory or a battery-backed RAM disk.

Our T1200H, on the other hand, has the distinction of packing a 20MB hard disk, a backlit screen and 1MB of RAM into a tidy 11-pound package. We also make an economical dual floppy disk version known as the T1200F that weighs just under 10 pounds.

And thanks to rechargeable battery power, all three are ready to work wherever you go.

For even more computing power, the T3100/20 is one of the smallest PCs with an 80286





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720KB
20MB HDD



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720KB
40MB HDD



T5100
80386
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144MB
40 MB HDD

Strength In Numbers.

microprocessor and an easy-to-read gas plasma display. It gives you a wealth of power and a 20MB hard disk in a trim 15-pound package.

Our T3200 goes even further, with two IBM-compatible internal expansion slots, a 40MB hard disk, an EGA plasma display system and up to 4MB of memory. Still, it only weighs a scant 19 pounds.

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powerful database software for only \$299 (which is nearly \$600 off the retail price).

And to all those numbers, we'd like to add one more: 1-800-457-7777. With it, you can find out even more about Toshiba's full line of computers and printers.

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N L Q

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READER HEAT, READER LIGHT

My First Time

I have never written a "letter to the editor" before, but I was so impressed with Directory Magic that I just had to send you my compliments.

If the quality of your magazine matches the quality of your free utility disk, it will surely be a smashing success!

Again, thank you for so promptly sending DM. I'm looking forward to PC/Computing.

James Biergiel
Goleta, California

Doctor Who?

Congratulations on selecting a fine bit of software to promote your new magazine. Directory Magic has become a part of my everyday software after only two days of use.

PC World, PC Magazine, Micro Cornucopia, ProFiles, Dr. Dobbs, and other forgettables are behind me now. Only Byte and Turbo Technix are still welcome here today.

Hopefully, PC/Computing will become a staple as well. After rereading the note that signed me up, I think the magazine sounds like a winner. Until DM came along, none of the freebie disks that were sent to me was of much value.

You're off to a good start. I wish you well.

Roy Bloom
Union Gap, Washington

Monster Mailbox

If your new magazine is as good as the promotional materials you sent, you should make it in spades, or bytes, or whatever.

Currently, my subscriptions include Compute!, Compute!'s PC Magazine, Computerworld, Family & Home Office Computing, InfoWorld, PC Magazine, PC Resource, and PC World.

I try to keep up with current devel-

opments, but don't always succeed. Retired from the classroom for six and a half years, with two paying jobs, and much volunteer work, I keep busy. My computer holds membership records for a group of 400, business records for one of my businesses, and helps edit a newsletter for another business group.

Best wishes for your new enterprise.

Arthur J. Snook
Warren, Michigan

Stay of Execution

Directory Magic seems too good to be true. I hope not.

As a struggling not-for-profit organization, we depend on volunteers, most of whom are computer illiterate like myself.

Your offer arrived during a traumatic endurance session with the PC. I decided not to pull its plug, give it an indecent burial, and go back to our faithful typewriter. Instead, I tried Directory Magic and decided to give the computer another chance.

Ellien Carroll, President
Storytellers International
Albuquerque, New Mexico

The Guru Is In

From your letter, it appears you are hoping to develop a "distilled" version of PC Magazine. What is "radically different"?

You have an opportunity to publish a truly different magazine that many of us need. PC World and PC Magazine should change their names to "CC" for "Corporate Computing." Clearly they are aimed solely toward the computer departments in corporations that can afford them.

Please recognize that there are 100 times as many of us trying to "go it alone" in small businesses that have no computer guru. Where do we go for help? Who will train us to operate our equipment? How will we customize our

software?

I have read every issue of those magazines and am *not* learning to use my computer. Furthermore, each issue becomes less understandable than the one before it.

Please remember, PCs were intended for those of us who want to become more profitable, more productive, or better managers using small computers. We don't want to know how to take them apart; we don't want to know about features that don't contribute to these goals. We don't want to become "power users."

Donald MacDonald
Palm Springs, California

The PC needs of small-business users are important to us, too. See "Instant Gratification" in this issue for tips on adding the latest in essential small-business tools—fax capability—to your PC. In future issues we'll feature stories on accounting, forms generation software, and other topics of interest to small businesses.—Ed.

My Secret Garden

Already PC/Computing is meeting a need in the computing community. The thirst for more knowledge is not easily satisfied. Another computer publication—especially one that fits so neatly into the niche you've found—will enhance your audience's reading time. We all have a secret desire to someday be power users. Along the way, publications like PC/Computing keep that desire alive.

PC/Computing is a shiny new tool, simple enough to put to use right away and yet complex enough to push us on to greater productivity and accomplishments. PC/Computing is multifaceted, and time spent reading from each section will serve to enhance its usefulness.

Denis R. Holmes
Lynden, Washington

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Presentation	40x25	40x25	40x34	45x25	40x28

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JOHN C.

D V O R A K

A

Anthony Dias Blue is 46 years old, lives in a posh house in San Francisco's ritzy Pacific Heights section with his wife and two kids, and is one of the nation's most prolific and talented wine and food writers. So what's this got to do with me? Computers, that's what.

Blue is part of the new generation of professional writers who use computer power to increase both their outputs and their incomes. I interviewed him last month about his craft.

Dvorak: You write for *Bon Appétit*, *Chronicle Features*, the *San Jose Mercury News*, and the *Wine Spectator*, and you do a daily radio feature for WCBS in New York. In addition, you've done three books, including *Anthony Dias Blue's Buyers' Guide to American Wines*. How do you do it?

Blue: Over the past five years I've developed a dBase III application that I can manipulate in a dozen different ways to produce a dozen different columns. I use WordPerfect and a utility that allows me to pull up dBase files and insert them into my documents.

Dvorak: This is all very interesting, but maybe we should go down to the wine cellar to see your surplus.

Blue: That's it? That's the interview?

Dvorak: Well, OK. How many wines have you cataloged with your dBase program?

Blue: I have over 10,000 wines with 10,000 tasting notes in the system. The



flexibility of the computer allows me to produce a book that is up-to-the-minute. I don't have to worry about rewriting and retyping.

At this point I figured I had asked enough questions. We all

know that computers make writers more productive and that a good database of wine-tasting notes is just what the country needs. So what I really wanted to see was the cellar. It was

**I had asked enough questions.
What I really wanted to see was the
wine cellar.**

where we could really learn something important. Maybe, just maybe, I could talk Andy (as his friends call him) out of a few dupes. From around the world he gets cases of top-quality wines for various tastings and for review in his books. There are a lot of duplicates, and the poor guy can't keep up. So he doles out some famous growths to the Andy Blue Fan Club. At the moment, that was me. The interview continued in the cellar.

Dvorak: So did you write the dBase application? Wow. Look at those old chardonnays. The collection is backing up on you. You should get rid of some of this stuff.

Blue: Yeah, I wrote the dBase application. When I started at Amherst I was a math major and wanted to be a math

teacher. Luckily, I went to a math professor's house one night and found him and his life to be the epitome of nerdiness and decided to change my major to art. But now I love computers.

Dvorak: Chardonnays?

Blue: Yeah, yeah. Here, do you want some ten-year-old chenin blancs?

Dvorak: Do you have any more of that 1970 Gruaud-Larose?

Blue: Didn't I give you a bottle of that the last time you were here!?!

Dvorak: Yeah.

Blue: I don't see any more of it. Maybe it got moved. So what else do you want to know?

Dvorak: Here's some old Mondavi Reserve cabernet. You'll probably never get around to drinking it.

Blue: Hey! Give me that! Here's some-

thing for you. Some old Jekel cabernet. It reeks of that grassy, vegetal Monterey flavor. I hate it. Maybe it's dissipated. Try it. Let me know if it's any good.

Eventually I talked him out of three cases. I even managed to find a few wines that were surprisingly decent.

Then one day the best wine showed itself from my newly acquired collection. It was one of Andy's discoveries, the 1985 Ilano Estacada (Slaughter-Leftwich Vineyards) cabernet sauvignon. The wine was from, of all places, Lubbock, Texas!

As I contemplated its brilliant ruby color and took a sip I thought, "Computers and wine. The perfect combination. Maybe I should do a follow-up interview." ▀

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D Y S O N

The promise of "groupware"—group software for use on local area networks—is that the all-powerful computer will at last help us mere mortals to organize our shared projects, manage our time, and meet our collective goals. The problem, of course, is that we have a very good reason for *not* doing those things well: they make us do other things that we simply don't like to do.

We don't like to be rude. We don't like to give orders. We don't like to contradict people or pull rank. We wish people could figure out unpleasant things for themselves.

As a result, groupware is not going to be universally welcomed.

One of the better packages around, The Coordinator, was once described as "fascist software." It knows what people are supposed to be doing, monitors what they are actually doing, and informs them when they're past deadline. What's so terrible about that?

What's terrible is that it makes everything explicit. Groupware doesn't observe the niceties. It doesn't wonder if you could possibly do something. It doesn't inquire into your health before it socks you with a rush project.

I remember the commotion I caused every time I released an org chart at the short-lived *Computer Industry Daily*, the Ziff-Davis venture I headed in 1985. Somehow, staff members had imagined that they reported directly to the top. The clear, explicit information on the charts wasn't always welcome.



Ostensibly, we value people equally, so we don't like to think about the differences in the time we're willing to spend with them, the money we're willing to spend on them, and the credence we give their ideas. But

groupware will ask us to do so. Who is a Priority 5 in your e-mail system? Are you a Priority 5 in *their* systems? Which projects go out first? The system wants to know. You can't just play

to the provenance of ideas or proposals. Just as one might say, "His money is green," one could add, "His ideas appear in green type, just like everyone else's"—unless, of course, you have a hierarchical system and the CEO's remarks appear in color. But you can't do that without being explicit.

Just as computers already have eliminated financial float, and e-mail will start to eliminate information float, groupware will start to eliminate work float. It will be tougher to put off decisions, tougher to ignore questions, tougher to delay handling issues.

That's why it may be hard for some of us to accommodate groupware.

To be successful, groupware is going to have to be introduced carefully, as a tool, not as a regime. Groupware won't

Groupware's fascistic style alienates people. Most of us would rather be coddled than commanded.

it by ear and let things sort themselves out—because they will usually sort out badly.

Consider Gibis, an "argumentation system" built at the Microelectronics and Computer Technology Center in Austin, Texas. It's a groupware tool that requires you to post arguments and declare whether they support or contradict each other, or are irrelevant. People who don't like to disagree with others might be uncomfortable with Gibis (although it might help them to express themselves). Of course, some people like to argue. But they may not like explicitness either. Gibis exposes "hand-wavers and double-talkers," one delighted user reports.

Groupware will also have a social leveling effect by making us less partial

run our lives, nor will it replace face-to-face conversations, drinks after work, shared effort, or respect for the people we work with. Yes, it will make some skills less important—being organized, managing one's time well, and having a head for details—because machines can do those things for us. Meanwhile, it will be easier to get decisions made, questions answered, issues resolved.

But leadership and intellectual skills will be more highly valued: we can be informed and coordinated by computers, but not motivated or uplifted by them. Maybe groupware will let us stop wasting time being subtle about trivial things so that we can be deep, thoughtful, and even emotional about important matters. ■



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SOMERSON

PAUL

Editor's Note: We discovered this story on our electronic mail system and are publishing it exactly as received, even though it is mysteriously dated 11 years in the future.



Las Vegas, Nov. 20—The fall 1999 Comdex was, as always, a bit disappointing. The star of the show was clearly the Yamagazi RoomTemp CryoModem I'm using to transmit this story. Yamagazi claims it blitzes out data faster than the speed of light, which means this report might have made it back to the office before the show even took place.

This year, the computer industry's companion show—Legaldex—nearly outdrew the hardware and software exhibits. With so many pending lawsuits and so much money at stake, it's really no surprise that Legaldex sprawled into 11 hotel ballrooms, two parking lots, and a hallway at the Liberace museum. The Apple booths alone commanded more than 30,000 square feet of space.

In what has turned into an annual tradition, IBM once again trotted out a new graphics standard, the 3DGA. Compatible with the MGA, MCGA, HGA, EGA, VGA, EVGA, QGA, VVGA, VHGA, VQGA, VMGA, VAGA, EAGA, GAGA, and, of course, CGA boards, this new standard heralds a "bold new era of channel profitability," according to IBM president and owner Sheik Akmar Mumani: "Now at last serious business users can have their fancy 3-D graphs float in space."

Big Blue also displayed yet another

new keyboard. The 143-key model sports 6 randomly scattered Ctrl keys, three more function keys, and an entire pad of SysRq keys (though IBM did not announce why anyone needs even one). To counter IBM's new

Blubus architecture, AST/Quadram/Hyundai announced Blubus-Plus, with an additional data line and slightly more shielding. Blubus throws off so much RF interference that airborne laptop users

2000 "Finally, the Year of the LAN." Other vendors are proposing that Comdex 2000 be dubbed "The Year of the Home Application," in an effort to prod the industry into developing at least one product that could justify buying a computer for use at home.

Ever-youthful Bill Gates's keynote address, "OS/9: The One You've Really, Really Been Waiting For," blunted criticism that this newest version was still too hard to use, too slow, and too memory-hungry: "Even though no third-party vendors have taken advantage of the advanced capabilities of the seven previous editions, dozens of developers are porting their applications over. And it will run just fine on any system with 30 megabytes of RAM, although you may need a bit more for your data."

The new 143-key model sports six Ctrl keys, three more function keys, and a whole pad of SysRqs.

are able to make their planes bank left and right by leaning on the cursor arrow keys.

The fastest-selling product at the show was IBM's just-released TBR (Technical Bug Reference) manual, a fat compendium of IBM BIOS- and chip-level errors that the industry has had to adopt as standards.

In response to the new IBM line of 240MHz machines, Compaq/Dell announced a 242MHz screamer, which it claims "makes the IBM box look like it's playing dead." At the other end of the spectrum, we counted 35 manufacturers still selling replacement motherboards for the original PC-1, switchable between 4.77MHz and 180MHz.

Sponsors of next year's millennial Comdex are planning to call Comdex

In the word processing arena, MicroPro, Microsoft, and WordPerfect have packed even more features into their bloated programs. MicroPro has purchased so many third-party utilities that WordStar Professional Classic 7.3 is now delivered on 73 disks. WordPerfect has streamlined its 16-volume manual.

Finally, Lotus announced its 1-2-3 WZ 50-dimension spreadsheet, a "quantum leap" above its previous 1-2-3 VZ 45-dimension version. Although users have been demanding this added power, say market analysts, they're still not exactly sure what to do with more than three dimensions. When pressed for a delivery date, Lotus officials would only say "sometime in the first quarter of the coming millennium." We can hardly wait. ■

PHOTOGRAPH BY RUVEN AFANADOR

JIM

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M

icrosoft Word is one of the powerhouses of PC software: capable, flexible, versatile, and as easy to learn and use as any comparably powerful program. But we've got to get straight just which Word we're talking about.



When Word for the PC was introduced four years ago, it was a mess: slow, clumsy, full of almost-there features and worlds of promise only half realized. It got a little better around Version 1.15 and became actually usable around 2.0. It turned the corner with 3.0 and now in 4.0 towers over its competition.

Along the way Word shed copy protection and gained speed, lost its stupid alpha command, and picked up a slick macro feature. Microsoft saw that some PC users—mainly in the computer press—had gotten so accustomed to XyWrite, the speed-at-all-costs entry, that they judged all other programs against it, faulting them if they didn't match XyWrite's vaunted speed. So Word got fast—faster, in fact, than XyWrite.

Seeing further that lots of people like nice, clean screens, Microsoft gave the user the option of hiding the menus across the bottom of the screen, then allowed cleaning up the screen altogether, coming as close to the blank-piece-of-paper metaphor as we're likely to see in a serious word processor.

Along the way, power was joined by—not diluted by—elegance. Word has the best support for laser printers in the business. It has the greatest ability to apply typesettinglike touches to your documents—like 12-point Times Roman type with 2 points of leading and 5 points between paragraphs. It has what is simply the best integral outlining feature in the business. It has magnificent footnoting and endnoting. Its glossary feature has a boilerplate facility unmatched by any other program. And in its style sheets—especially the style-by-example flavor found in Version 4.0—it has the easiest-to-use and yet the most powerful tool ever seen for creating standard-format (continued on page 26)

I

t's not that Microsoft Word is a bad word processor. In a world of no alternatives, Microsoft Word would be adequate. But this is not such a

world, and Microsoft Word is just not acceptable as a high-end word processor.

I had hoped, before beginning this debate, to find that Microsoft had substantially improved Word in its 4.0 release. No dice. As Pete Peterson of the WordPerfect Corporation (the leader of

the pack) told me, "It's improved, but it's *still* Word!" There lies the rub. Word needs complete rewriting, not patching.

Here's the way I'd describe the product: "Word—the 19-line word processor. Yes, 19 lines. Type to the bottom of the page and watch how the whole page jumps up nine lines. Suddenly you're in the middle of the screen. Totally unacceptable."

It's the kind of thing I used to see on word processors that ran on the Commodore PET. Seeing the page jump around while you're typing is incredibly distracting. When editing the bottom line, it's impossible to contend with suddenly finding that the cursor has moved up nine lines.

Much of the cursor movement makes no sense. Try scrolling the cursor up and down the page. Its movement shows no logic.

Now, for a good laugh, try hitting the Alt and CapsLock keys at the same time while in the CapsLock mode and see what happens. On my machine I get permanent CapsLock in colors! Will they ever get this program bug-free? See what happens if you fill up a hard disk with a Word file. Try to escape from *that* mess!

Talking about escape, the way the Esc key is used in Word is the worst. Instead of walking you out of a series of menus one at a time (which is the current convention), it throws you back to the beginning. Wasted keystrokes are par for the course with Word.

It's possible, Jim, that you like this product because it serves some obscure specialized (continued on page 26)



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Obviously, John can't tell "different" from "bad." And he's gotten stuck in how things were, not how they are. That nice, original 16K PC on your desk is swell too—huh, John? Still saving your files to a cassette recorder?

But I digress.

Microsoft Word on the Macintosh is, of course, a completely different critter. It has moved (does this sound familiar?) from a slow, clumsy product in its first release—one that promised much but didn't quite deliver—to the state of the art in Mac word processing. Now FullWrite and maybe WordPerfect for the Mac are giving Word a run for its money. Great: both products are shooting at Mac Word circa 1987. Time moves on, even if John doesn't.

Word bashers love to wallow in nonsense such as John's claim that the Alt-CapsLock combination kicks Word into "permanent CapsLock in colors." Sorry, John, but Word doesn't do that on IBM PC ATs, Compaq Deskpros, or any of the other DOS machines on which I've tried to duplicate your problem. Now just what kind of white-box clone was that you were using?

Word is easy to learn and easy to teach. For a start, it makes more intelligent use of the function keys than WordPerfect or (I'm trying to take this seriously) MultiMate. Word has a different paradigm for word processing, and anyone who looks at it objectively will understand that it's a much more coherent paradigm.

Indeed, one of the joys of teaching or learning Word, especially on a PC, is that once you figure out how to do a few things, you can almost always guess how to do other things. That's because, to a degree unmatched by any other mainstream PC software, Microsoft Word is internally consistent: it's the thinking person's word processor.

Some people will always love the finger-tangling function-key-plus-something-or-other approach of WordPerfect. Some people will always go for the speed and the memory conflicts of XyWrite. Some people will always prefer WordStar, for that matter, so they can Ctrl-this and Ctrl-that. And surely there's someone, somewhere, who will defend DisplayWrite.

If you use and like one of those programs, you and I have no argument. But none of them is a champ. Microsoft Word is.

Too bad some people haven't noticed. Or can't tell the difference.—JS

DVORAK

purpose appreciated by one user out of a thousand. What I refuse to believe is that you actually use this software for writing. If you do, why? Products like XyWrite and WordPerfect are far superior. Most people who use Word apologize for doing so, if they'll admit to using it all. To be honest, I think WordStar 3.3 is better. At least WordStar does almost everything you need without requiring you to load disks and disks and to have gobs of memory available.

Clumsy, awkward, verbose, clunky—these are the themes of Word. The only succinct thing you get when you buy Word is the shrinkwrap. It even comes with a little book called a "pocket guide." Have you seen this thing? It's huge. What kind of pocket is it supposed to fit in? And this booklet is supposed to have tips? What tips? How about what to do when the disk fills up? All the tips are obscure. The same lack of usefulness is inherent in the product. It has bells and whistles that should never be found in software. Like a command that allows you to adjust cursor speed. Who needs that? Can't Microsoft do a little research and find the optimal cursor speed? I mean, this product takes programmability to a ludicrous extreme.

Give Word to some office temps and let them go in and screw up a few of its many bizarre settings, and see what happens to productivity. Overall, I guess my disappointment stems from the early promise of Word 1.0. Sure, it didn't work well, but it promised us a front end for typesetting and perhaps a new generation of word processing. It never delivered on the promise.

Unfortunately, it was programmers (who never use word processors) who began to direct it. It shows. It's no coincidence that WordPerfect slaughters Word in the marketplace. I can't believe that anyone, if given a choice among Word, WordStar, XyWrite, WordPerfect, and Sprint, would choose Word. It would never happen.

Which brings me to my final point. Has anyone at Microsoft heard of the word *elegant*? In the Macintosh world I look at the lone disk provided with WriteNow!—the elegant word processor that does everything but slice bread—and wonder why a megacorporation like Microsoft can't produce code like that. What does Bill Gates do for his billion dollars, anyway? Maybe he should stop talking about how good a coder he is and sit down and code something. I suggest he start with Word.—JCD



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NEW!

It was hot in Fort Worth this summer, but the heat didn't come from the sun. The folks at Tandy unleashed a revamped 1000 line that sizzles. Pumped up, slimmed down, faster, smarter, and cheap. It's going to be a lot harder to say no to a home computer.

The low end of the 1000 line, the HX, remains unchanged—right down to the \$699 price. But the second-tier SX is reborn in the 1000 SL. And the top-of-the-line 1000 TX is replaced with the 1000 TL.

The \$899 SL is powered by an 8086 processor, which is the same chip used in IBM's PS/2 Model 30, as Tandy representatives are quick to point out. It uses a standard 360K, 5¼-inch floppy drive (you can also add a second 5¼-inch or 3½-inch drive), provides 384K of memory expandable to 640K, and offers five expansion slots.

The \$1,299 TL is the performance workhorse of the two new machines. With it you get a faster 80286 processor, a 720K,



**Tandy's powerhouse:
the 1000 TL**

Hot News from Fort Worth

3½-inch floppy drive with room for two more drives (including a 5¼-inch drive if you prefer), 640K of system memory expandable to 768K, and a battery-operated real-time clock.

Both the SL and TL use CGA-compatible graphics, which Tandy engineers have tweaked to give a maximum resolution of 640 by 200 pixels in 16 colors.

But forget the processors, the expansion capabilities, the graphics, and the new 101-key keyboard. The real

power lies at the heart of these new machines, in a 512K ROM chip. It's the key to the computers' easy operation.

Turn the computers on and they use the ROM chip to boot DOS (Version 3.3) and call up the DeskMate graphical user interface. Because the software is in ROM, in only a few seconds you're ready to go.

The chip also contains some common DOS utilities and a 90,000-word spelling

dictionary that can be accessed from any application written for DeskMate.

But the pièce de résistance of the two new machines has to be heard to be appreciated. The SL and TL have music and speech capabilities provided by an analog-to-digital and digital-to-analog converter that lets you record sound from any audio source, digitize it, store it on disk, then play it back. A jack on the front of the machine accepts input.

The music and sound editors in DeskMate let you record, edit, and play back anything—from your voice to an entire symphony. For now, the sound software is pretty simple, admits Gene Schenberger, DeskMate product manager, but it does let you "see what can be done with the hardware."

Merchandising director Howard Elias agrees that the sound feature is more "sizzle than steak." But that will change, he says, when sophisticated applications (language labs, music courses, and speech therapy head the list) are written by

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Too good to be true? Believe it. Quantum Computer Services, in a joint venture with Tandy, is bringing PC information online at bargain prices.

Pay one monthly fee, \$9.95, and get unlimited access to PC-Link and its databases—stock quotes, headlines, software reviews, entertainment news, quizzes (complete with prizes), reference materials, home shopping services, and Tandy news and customer support.

software developers.

Of course, Tandy needed to tinker with its business products, too, so its office-oriented 3000 HL has been replaced with the 3000 NL. Product manager Lisa Wilkinson concedes that this is "not a glamorous machine; it's a practical one."

But she's confident its faster processor (a 10MHz 286), reconfigured slots (three 8-bit, four 16-bit), and new high-performance memory slot (it accepts up to 8MB of high-speed RAM) offer an incremental improvement over the now-defunct 3000 and 3000 HL.

The NL comes with 512K of memory and a high-density 3½-inch drive (with room for a second 3½-inch and two 5¼-inch drives), supports up to 344MB of hard disk storage, and has VGA graphics and a bidirectional parallel port for image scanning. All this at a base price of \$1,699. —Chris Shipley

Not enough? Move into the PC-Link Plus side of the service (which costs a 10-cents-per-minute premium) to get interactive lectures, homework tutors, forums, software demos, electronic mail, and more.

The service is available between 6 P.M. and 6 A.M. each weekday (though you can log on during other hours for a 15-cents-per-minute surcharge) and 24 hours on weekends.

The PC-Link software needed to access the service is bundled with Tandy's DeskMate program. You can also get it with the purchase of a \$99.95 Radio Shack 1,200-bps modem, or buy it separately for \$29. Currently, PC-Link is sold only through Radio Shack stores. —Chris Shipley

DeskMate: A Perfect Match

What makes Tandy so confident of its new 1000 line? It isn't processing power, design, or capacity. It's DeskMate.

DeskMate is just the right complement for Tandy's hardware. It's a tight, clean, graphical user interface that makes the hardware as easy to understand and use as a new car. Everything is where you expect it to be. Drive one application, you drive them all.

The heart of DeskMate resides in ROM, so you never

need to touch a disk to get started (although you will need to shuffle floppies to run the applications). Boot the machine and meet DeskMate, a series of drop-down menus that insulate you from the esoteric A prompt.

DeskMate offers a series of utilities (calendar, address book, calculator, and alarm) and applications (text editor, simple spreadsheet, data filer,

forms handler, and drawing program), and the interface supports third-party applications written for the DeskMate environment, although there aren't many of them yet.

DeskMate isn't the be-all and end-all for Tandy 1000 series users. But according to product manager Gene Schenberger, the program is intended to give users "something practical for their systems—so they don't have to spend any more money to make the computer useful right out of the box."

—Chris Shipley



Sprint: A Cure for the Learning Curve

I had to learn Arabic once. Twelve years later, I learned WordStar 1.0. Unlike one of those smug, bilingual-from-birth prodigies, however, I had to struggle with both. Which is why I've never found a compelling reason to squander productive time learning another word processor. WordStar will do.

Borland International (whose French president, Philippe Kahn, is smugly trilingual) must believe that a lot of people share my stubborn attitude, because it's developed Sprint, a word processor you don't have to learn. Just load Sprint and punch up a new concept: an interface menu. Choose the emulation you know best—WordStar, WordPerfect, Microsoft Word, or SideKick—and those familiar commands you've sweated bullets to learn are there, function keys and all.

And this is just one of the endearing features among Sprint's exhaustive list. (The program fills 11 disks and is documented in three manuals totaling 1,267 pages—none of which I needed to read before using

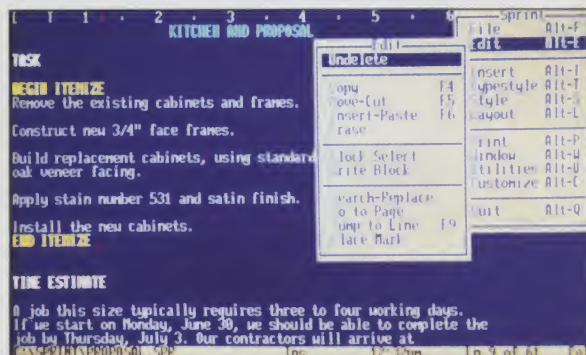
it.) Sprint also quietly backs up your work every three seconds, another idiot-proof characteristic I find appealing.

If you want to use the zillion features, though, you have to switch back to the Sprint interface menu. Once there, you may decide it would be easier to learn Arabic: although arranged logically into pop-up menus, there is so much here that you have to wonder. You can have up to 24 files open at once, for example, and use screen windows to work with as many as six of them simultaneously. At least the thesaurus and the spelling checker (which is adequate but slow) are available while using the interface emulations.

Sprint supports 350 printers as well as some typesetters. It also claims some desktop publishing capability, though at first glance this appears to be more trouble than it's worth.

And if you're interested, a separate 504-page manual offers detailed instructions on customizing the program to do just about anything short of mowing the lawn.

For \$199.95 (suggested retail; street prices will



probably be much lower), Sprint may be worth buying to use only occasionally—to train new personnel, say, or to translate to and from other word processors. Besides the three interface emulations, it translates files to and from DisplayWrite 4, MultiMate, and others.

Sprint is not sexy. Especially in its emulation modes, it's as much fun as a comprehensive dental plan. It costs a great deal less, though, and may prove nearly as useful.

—Edward D. Sheffe

Punch up Borland's Sprint and choose a word processing interface you already know. Industrious users can even create their own.

PS/2: Just Say No

If a band of angry consumers can muscle the Coca-Cola Corporation into reinstating the original formula for Coke as Coke Classic, maybe a couple of California upstarts can preserve and protect classic PC technology.

Jim Glass and Tom Evatt— aerospace engineers by day, systems consultants by night—are waging a battle against IBM's rising star, the PS/2. The opponent: "The army of zombies who will buy anything IBM puts out," Glass says.

Sporting T-shirts and buttons that declare "PS/2, Just Say No," the two have launched a drive to save the

eclipsed PC architecture. PS/2s, Glass contends, are tremendously expensive, needlessly complex proprietary systems. "The whole thing just seems like a bad idea to us," he says.

Devotees of PC "Classic" can join the fight. The shirts—small, medium, large, and extra large—cost \$12, plus \$1.50 for postage and handling. Buttons go for \$1, plus a 50-cent shipping fee. Send a check or money order to Advanced Systems Consultants, 21115 Devonshire St., Suite 329, Chatsworth, Calif. 91311, (818) 407-1059.

—Chris Shipley



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Until now, CD drives have come in two forms: one that can only read back prerecorded information, and another that allows information to be written once but not erased.

New CD-ROM drives promise to hold hundreds of megabytes on CD-sized discs yet work as quickly, conveniently, and reusably as today's best hard drives.

Companies are racing to bring products to market—and racing to steal headlines away from the competition. Tandy won the first heat as quickest to announce, heralding its recordable CD system in late April. In June, Advanced Graphics Applications (AGA), of New York City, followed with its rewritable optical disc system, the Discus Rewritable.

Tandy has made Texas-sized promises for its recordable CD machine. With it, you can make little silver discs that will play on your stereo or computer with equal ease.

AGA's rewritable discs come in cartridges. Although the AGA system uses optical technology, just

like CDs, it requires its own magneto-optical recorders and players.

If Tandy deserves any award for its headlining victory, it's forchutzpah in announcing a product to the public seemingly before mentioning it to the engineers charged with its development. It could be a year or more until there's a drive to run the Tandy disc.

AGA, on the other hand, based its dream machine on equipment and technology you can buy now. The complete AGA system will ship in November, according to company officials.

The drive is made by Olympus, of camera fame, and the discs by 3M. AGA adds its own interface and software to match the hardware to your PC and sells the package for \$4,995. Discs, which hold 650MB, cost \$250 each.

The AGA system is called a "rewritable" optical disc because you can write new data a million times or more without degradation. The drive chugs along at about the same speed as an old XT hard drive.

If Tandy and AGA deliver on their promise, you'll soon be able to read and write a lifetime's worth of information on a single compact disc.

—Winn L. Rosch

FlexLand

Do you suffer from leading-edge anxiety? Do you want the latest computer equipment, but worry that something better will eclipse it in a matter of months?

ComputerLand of New York thinks it has the cure. Its Flex program lets you lease computer hardware for three years, during which time you can upgrade all or part of the system configuration.

To upgrade, you simply pay the difference between the retail price of your leased equipment and the value of the new equipment. So the Model 50 you buy today can be "flexed up" to a Model 80 in the future.

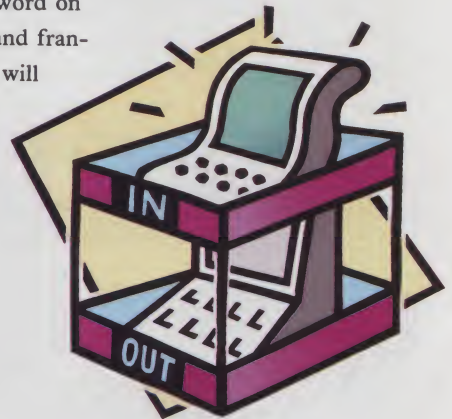
You needn't exchange PC for PC. ComputerLand lets you trade any part of your system for any other piece of equipment. So, for instance, you can swap a printer for a monitor.

A person who upgrades twice can save as much as 30 percent of the actual purchase price of the same equipment, asserts Richard Fagin, president of ComputerLand of New York. But if you don't upgrade your leased equipment, you won't reap the benefits of the program. In fact, you'll pay about 10 percent over the purchase price.

"This is not for equipment you're really confident will not grow," says Fagin. "It's for power users and people whose high productivity you want to leverage."

So far, there's no word on whether ComputerLand franchises in other states will offer similar plans.

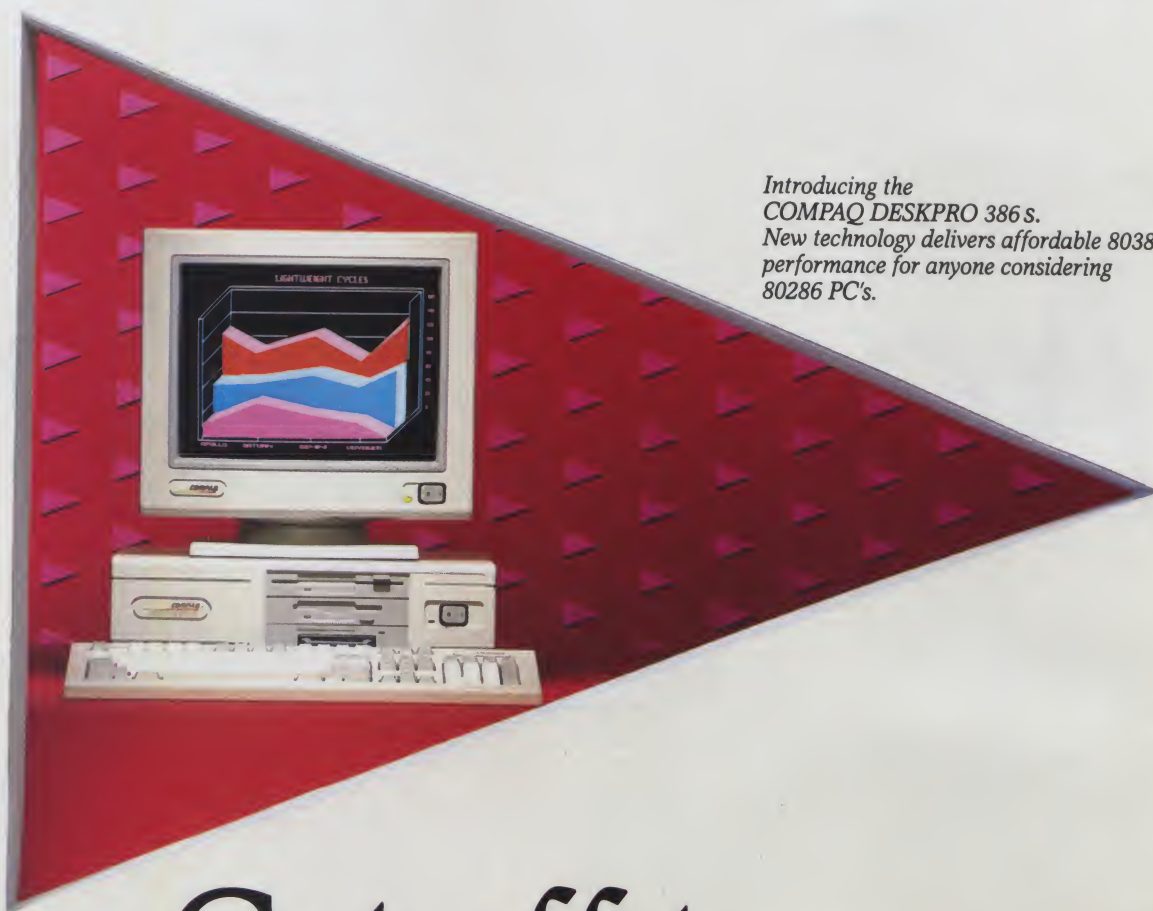
—Jane Hallisey



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*Hereafter referred to as 80386SX, 80386 and 80387 respectively.

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Software Training Made Easy

No more manuals. No more gnashing of teeth and rending of clothing. This could be the answer to many a software user's nightmare.

Eric Bromley, of Pac Man fame and now president of Penguin Products, has developed a solution to the problem of learning new software. He calls it the Simplifier.

Instead of wading through a morass of user manuals, be-

ginners just pop a cartridge into this 9½-by-11-inch PC add-on and let an electronic tutor guide them safely and painlessly through uncharted software waters.

This nifty little product is "a miniature artificial intelligence-based expert system limited to a very tight universe," says its developer.

For about \$600 you get a console with 35 keys and two slots for software cartridges. Cartridges cost about \$80 each and come equipped with an expert system and enough memory for some customizing once you become a pro.

Currently, cartridges are available for Lotus 1-2-3, MultiMate Advantage, Microsoft Word, DisplayWrite 4, and WordPerfect. Coming this fall from the Bloomfield, Connecticut, firm is a dBase III Simplifier. Cartridges for PageMaker and Ventura are also in the works.

Oh, the Simplifier does come with a manual, but Bromley says it's a very small one.

—Jane Hallisey

One Computer: Many Configurations

With its new CompuStar line, Wells American presents a chameleon PC. Need an 8086? CompuStar fits the bill. Want more processing power? CompuStar becomes a 286. Need even more? It's a 386. Thinking about a PS/2? CompuStar has a Micro Channel bus. Rather stick with an AT? CompuStar has an AT bus. Not sure? Then CompuStar is both.

In short, CompuStar's convertible bus is user-configurable. The whole machine, in fact, is user-configurable. Stripped down, it is little more than a sturdy aluminum box with a 220W power supply and an input/output module with drive and graphics controllers (for VGA, EGA, or CGA, analog or digital). Its floor-standing tower design leaves lots of room to create your own system. Take your pick of an 8086, 80286, 80386SX, or 80386

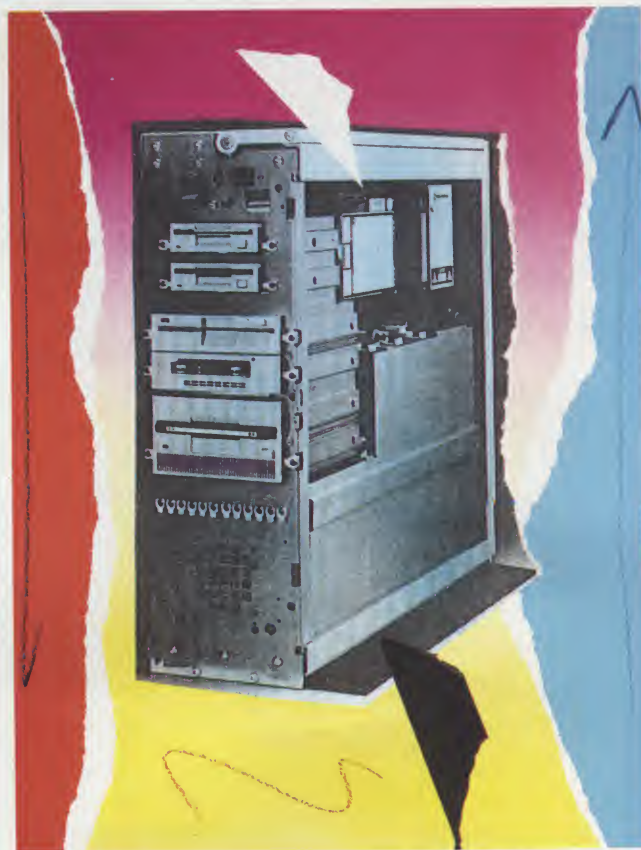
processor. Fill up any or all of the six front-accessible drive bays with hard, floppy, tape, or optical drives. There's even a seventh full-sized drive bay inside.

Need expansion slots? The CompuStar's got slots galore. Choose up to 13 AT expansion slots, 10 Micro Channel slots, or some of each. Use one of each plug-in bus module and get seven AT and five Micro Channel slots. And don't waste them on ports. Parallel, mouse, keyboard, VGA, EGA, and two serial ports are built in.

Wells American, in West Columbia, South Carolina, is offering a base model 10MHz 8086 with an AT bus (seven slots), floppy drive, and keyboard for \$995.

The 286 module is ready now, and 386 and 8086 modules will be available this month. The snap-in PS/2 bus adapter and the 386SX module are expected to be ready in October.

—Chris Shipley



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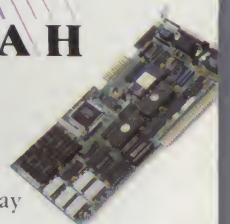
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CIRCLE NO. 199 ON READER SERVICE CARD.

It's an 8514/A Compatible—Or Is It?

Until now, if you wanted the ultimate in PC display resolution, you had to bite the bullet and buy IBM's 8514/A display adapter and a PS/2 to go with it. Big Blue's best, the 8514/A has 1,024-by-768-pixel resolution and 256 simultaneous colors.

Several firms recently announced plans to market lower-cost clones of the pricey graphics card. But as of this writing, only one manufacturer—Enertronics Research of St. Louis, Missouri—has actually delivered a product to dealers' shelves.

The Aurora 1024 display adapter, Enertronics claims, is up to 50 percent faster than IBM's card, but maintains full software compatibility with the 8514/A. Serving a market IBM apparently forgot, the board will work in any non-Micro Channel PC.

But the Aurora board is not a hardware clone of the 8514/A. The Enertronics adapter uses a different set of chips and is thus not compatible with the 8514/A at the register level—the strictest test of compatibility. As a result, programs that use hardware-specific functions of the 8514/A may not run on the Aurora 1024 unless a special software driver is installed.

Therein lies the rub.

Enertronics insists this is not a problem, since the Aurora 1024 is completely compatible with the 8514/A Adapter Interface (AI), which acts as an intermediary between software programs and the adapter. Software written to the AI specifications will be compatible with any AI-compatible graphics board.

IBM insists the AI is the

way to go and refuses to release specs for the register to anyone—that is, anyone except Microsoft, which needs them to complete Windows and Presentation Manager for OS/2.

This means that 8514/A clones compatible only at the AI level—such as the Aurora 1024—could hit a snag if you tried to run them with those two programs. Enertronics, however, says it will supply drivers for Windows and Presentation Manager, to work around those difficulties.

And Microsoft insists it

will resist the temptation to write faster, register-level programs and will use the AI for all applications programming, so clone boards compatible with the AI shouldn't run into problems.

While IBM won't tell you the hardware specs, Video Seven, an Enertronics competitor, will. Video Seven says it has reverse-engineered the 8514/A and is making the register specifications it has derived available to programmers. The company plans to

manufacture a register-compatible 8514/A adapter.

This leaves the Aurora 1024 in a land of quasi-compatibility. By supporting the functionality of the 8514/A adapter interface, it can claim to be 8514/A-compatible. And as long as software developers play by the rules and write to the AI, this board is a safe bet. But if Video Seven's specs are correct and programmers use them, only adapter boards that are completely compatible with the 8514/A's internal architecture will do. —Doug van Kirk

Let Your Modem Do the Walking

Where do you turn when you don't know where to turn? If it's electronic bulletin boards you're looking for, try Ed Gelb's

BBS phone numbers from all over North America. You can search for boards by area code, city, state, or province, and Gelb is working on a system that will let callers search for boards that cater to special interests.

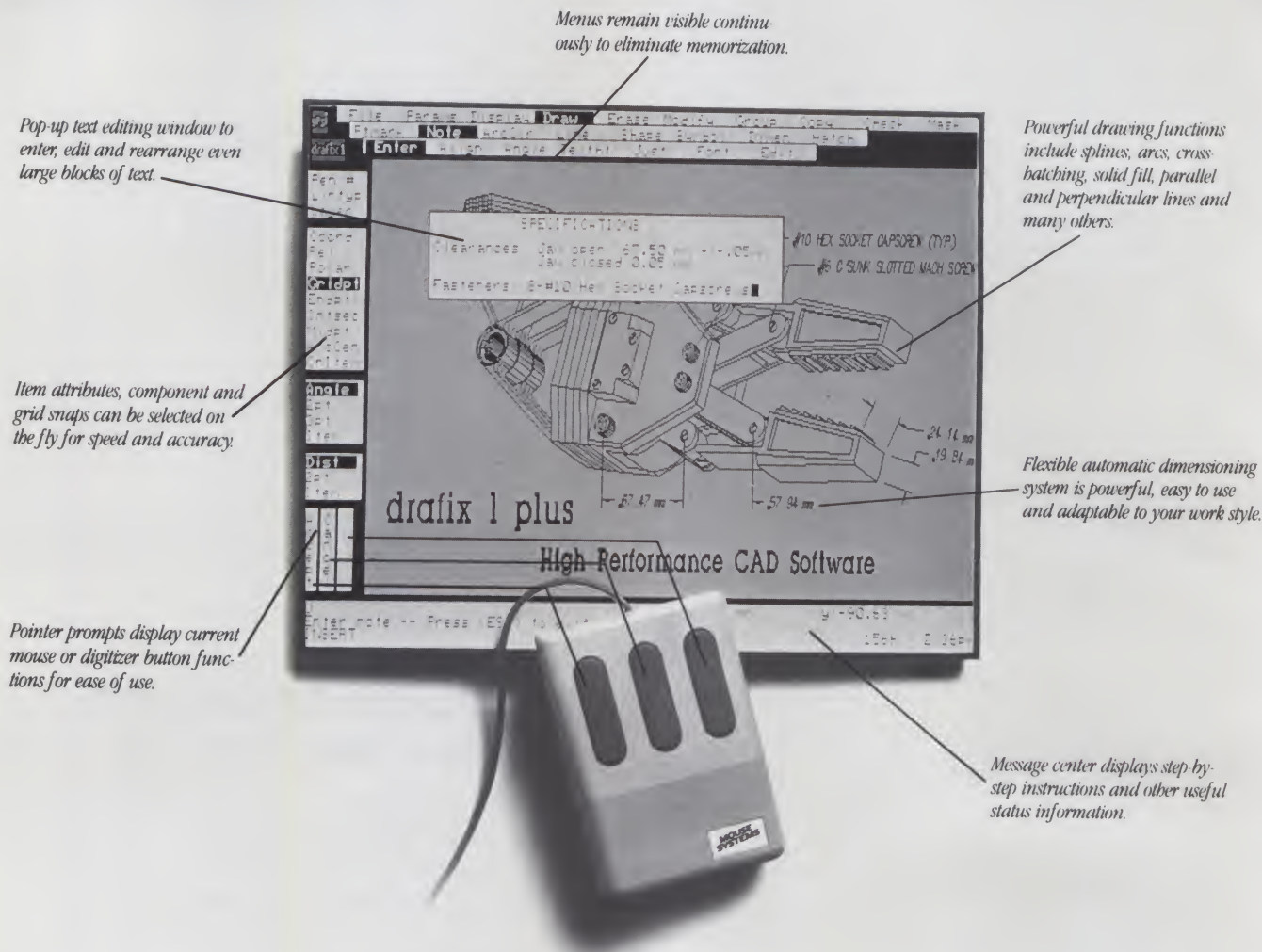
A quick cruise through area code 312 (Chicago and environs) turned up several hundred bulletin boards with specialties ranging from public domain software and C language programming to spinal disorders, Hare Krishna, and online dating.

Gelb charges \$10 for 200 minutes of access—more than enough time to sort and download a phone book's worth of databases. Or you can earn membership time by identifying new boards. To give Gelb's directory a try, call (201) 694-6835. —Chris Shipley



Instant Bulletin Board Phone Directory.

A bulletin board system itself, the dial-up directory lists over 10,000 verified free-access



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CIRCLE NO. 245 ON READER SERVICE CARD.

The Price Tag Is Just the Beginning

There may be gold in them thar hills, but according to projections from two market research firms, the real money can be found in computer maintenance.

Computer users will spend a whopping \$2.2 billion for PC maintenance in 1988, according to a report from Future Computing/Datapro. That figure is expected to rise to \$3.2 billion in 1989, \$4 billion in 1990, and \$4.8 billion in 1991, says Elise Sillers, an analyst with the Dallas-based research group.

The International Data Corporation of Framingham, Massachusetts, adds technical workstations to the mix and projects that maintenance revenues will reach \$5.7 billion in 1988 and increase at an average annual rate of 14 percent through 1991.

How much of that \$5.7 billion will come out of the average user's pocket? According to Mary Ellen Palma, research manager for IDC's customer service program, the average yearly cost for on-site repair is 8.5 percent of a computer system's purchase price and 10

percent of the price of a printer. For those willing to schlepp equipment in for repair, and for daredevils who want to do it themselves, the average yearly cost drops to 5 percent of the system's purchase price and 8 percent of the printer's price.

But users can help keep their maintenance costs down by remembering that user friendliness is a two-way street.

"You wouldn't believe the things we find inside that box," says Kevin MacConnell, account manager with Icon Computer, a Tustin, California, maintenance firm. "Everything from dead bugs to M&Ms."

In fact, user sloppiness is one reason Icon offers twice-yearly routine maintenance checks. MacConnell says he's found dust balls ("You know, the kind you find under your bed") inside PCs and cigarette burns on keyboards, courtesy of careless smokers who rest their burning butts in the pencil holder above the keypad.

"Smoking and PCs don't mix," he says.

—Susan Jelcich



Get the Big Picture

The lesson about the incompatibility of monitors and video boards is sometimes a tough—and expensive—one to learn. Plug the wrong monitor into your PC and you'll get a light show, and with particularly importune combinations you'll have flames shooting out the rear of your terminal.

With its Ultra 16, Princeton Graphics Systems of Princeton, New Jersey, eliminates these worries and gives you a few extra inches of display to boot.

At 16 inches diagonally, the new high-resolution color display is 2 to 4 inches larger than the average monitor coupled with a PC or compatible. Its automatic synchronizing system locks onto the signals of any video adapter you use—on PCs as well as on Macintosh IIs and SEs. As long as you match the Ultra 16's cable to your connector, you can plug it in without needing a fire extinguisher by your side.

Princeton claims its Ultra 16 has the widest range of synchronizing frequencies, allowing it to accommodate the greatest variety of display adapters. In fact, it just edges out NEC's MultiSync line by a few cycles at the high and low ends of its range.

Like most of the new breed of monitors, the Ultra 16 features both digital and analog inputs, so it will work with everything from a monochrome to a VGA-equipped computer.

The Ultra 16 includes all those little extras you expect in a state-of-the-art system—a tilt-swivel base, a monochrome text mode, and a high-contrast black-matrix nonglare screen—all for a pricey \$1,375.

—Winn L. Rosch

Personal Information Managers: Relief for the Organizationally Impaired

Are you one of those people who have to write notes to themselves to remember to take out the garbage? Do you believe that 3M's Post-its are necessary for your continued survival? If so, your salvation may be at hand.

The first generation of personal information managers is here—and they're more helpful, in some cases, than a personal secretary or devoted manservant. These products blend the power of databases, outliners, word processors, and text-searching software.

Like conventional databases, personal information managers allow you to view your information from many different angles by using a query language of sorts. But instead of following rigid, complicated rules about file structure and so on, data are simply entered as text.

Many personal information managers feature speedy text

searching, a boon to the amnesiacs among us and to those who need to find a text string in disparate kinds of files, such as those created by spreadsheets, databases, and word processors.

Word processing hasn't been forgotten: most of these packages allow you to insert, edit, delete, cut, and paste text as easily as anything this side of WordStar.

When all wrapped up in a neat package, the result is a program that lets you randomly collect your thoughts and reassemble them using whatever criteria strike your fancy. Early outline processors only hinted at this kind of versatility.

At list prices ranging into hundreds of dollars, however, it remains to be seen whether these programs will gain ready acceptance.

—Frank Bican

Get the Grand View

Symantec has earned a reputation for such exciting software products as Q&A and the ThinkTank outliner. Now its information manager, GrandView, will no doubt add to the buzz.

GrandView can be thought of as ThinkTank past puberty. Symantec uses the somewhat contrived phrase "power outlining" to give it a sense of GrandView's prowess as compared with its sibling.

With its variety of outlining functions, GrandView could be the perfect tool for assembling marketing plans, agendas, schedules, project maps, and speeches. Its functions include alpha or numeric sorting, automatic headline wrapping, date and time stamping, and more.

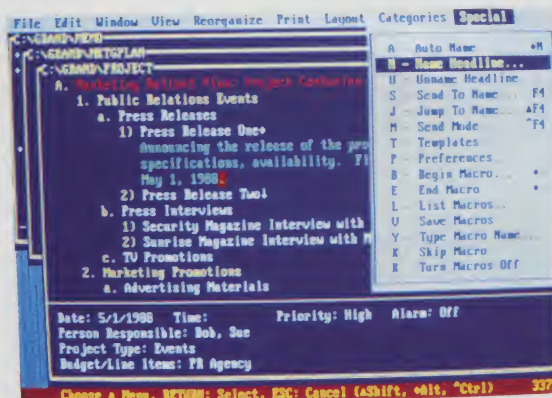
A GrandView "textbase" isn't carved in stone once you enter the data for an outline. You can extract in-

formation based on any category you define—by date, name, or priority, for instance.

Symantec, based in Mountain View, California, has also built a fairly competent word processor into the package. This is no minor inclusion, because the only external word processor files that GrandView can use directly are those from WordStar.

Owners of other word processors will have to use their programs' translation facilities to convert documents into ASCII format before GrandView can use them.

The onscreen display is both helpful and attractive, with pull-down menus for all the major functions. Other noteworthy features include keyboard and editing macros, onscreen help, data input templates, printer fonts, and a 100,000-word spelling checker.



A retail price of \$295 seems reasonable for GrandView's information management flair. Current owners of ThinkTank can upgrade to GrandView for \$89.

—Frank Bican

The screenshot shows the Lotus Agenda interface. At the top, it says 'File: C:\AGENDA\AGENDA'. Below that, there's a list of tasks with details like 'Who', 'Dept', 'When', 'Priority', and 'Phone'. A table below the tasks lists contacts with columns for Name, Dept, When, Priority, and Phone.

Who	Dept	When	Priority	Phone
Liz	Marketing	10/17/87	med	543-9977
Sam	Legal	10/06/87	low	477-7676
Jim	Sales	09/01/88	low	909-6343
Bob	Sales		high	232-1766
Liz	Mktg	07/31/88	7	321-1156
Tom	Marketing		high	543-9977

For Your Ize Only

Ize—as in organize, summarize, prioritize—is an outstanding text retrieval system with features galore.

Persoft, based in Madison, Wisconsin, has included in Ize a surprisingly complete text editor that's good enough to replace most word processors for all but the largest manuscripts.

But if you'd rather not use Ize's text editor, you can query text files assembled with other software programs. The list of compatible programs currently stands at 28, including Lotus 1-2-3, Windows Write, Word, MultiMate, PC-Write, Quattro, Symphony, WordPerfect, WordStar 4.0, and XyWrite III.

With Ize's so-called Hot Links to other programs, you can search for a character string within your

WordPerfect directory, for example, and then immediately jump to WordPerfect, where the text will be waiting on the screen, ready to be edited.

Another endearing feature is the "fuzzy search." If you can't quite remember the exact text or spelling, simply preface the search with an ampersand (&) and Ize will find any close match; that is, entering "&base" will find such words as baseball, textbase, and even debasing.

Other niceties include keyboard macros, data encryption, optional memory-resident operation (although it gobbles up 320K of memory), data entry templates, alarm clocks, and print queuing.

The \$445 package is bundled with exceptionally well-written documentation, so you can have Ize up and running in a matter of minutes. —Frank Bican



No Hidden Agenda

If you like Lotus 1-2-3, you'll love Agenda. That seems to be the thinking behind this personal information manager, which features similarities to Lotus's best-selling spreadsheet at every turn.

Not only does Agenda have the look and feel of its famous relative, but its businesslike documentation is liberally sprinkled with spreadsheet terminology. The net result is a learning curve approaching zero for all but the few people who haven't been exposed to 1-2-3.

Agenda performs its management magic by dividing each entry into three parts: items, which function as headings for the entry and which can be up to 350 characters in length; related notes, which can be up to 10 pages in length; and categories for dates, priorities, nicknames, and other personal laundry lists.

While this may sound complex, in operation it is not. Simply ask for a group of items in order of priority, date, associated name, or whatever, and the list will be sorted and displayed before you've lifted your finger from the Return key.

For repetitive tasks such as report generation, Agenda includes a macro facility that automatically records keystrokes.

A pair of utilities is provided to convert ASCII text files and Metro List Manager files for use with Agenda. In addition, Agenda provides a language to allow the text conversion program to work with non-standard files.

Using Lotus Agenda is easy enough—almost intuitive, in fact—but the product lacks some of the features of several other personal information management packages, such as networking and e-mail. These omissions wouldn't seem so bad were it not for the suggested retail price of \$395. For that many pesos, couldn't Agenda do more?

—Frank Bican

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SoftSafe also includes a powerful virus detection/protection

option. It checks your critical system files for any tampering each time you boot (start) your computer. If infection is detected, SoftSafe sounds an alarm and visually indicates which files have been attacked. You can then choose to KILL or IGNORE the virus.

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Color Me Business

Corporate America is going primary. Primary colors. Like birthday balloons, everything from paper clips to file folders now comes in shades of red, blue, and yellow—as well as green, purple, and orange. Now Kao Corporation of America in Mountain View, California, offers full-color floppies.

The Rainbow Pack lets you color-code data files. "Misplacing files can cause big business to lose big money," says Bud Barclay, Kao's marketing direc-



tor. "These diskettes help prevent that." But he concedes that to get the most out of the Rainbow Pack, you've got to be organized from the start.

Don't roll your eyes. The subsidiary of the Japanese Kao conglomerate put a lot of research into this one.

"We ran seven focus groups to test some ideas we had for promoting purchases," Barclay says. "And they just went wild over the colored diskettes."

—Anne Studabaker

The VDT Debate

Is the dispute over video display terminals a case of Big Brother sticking his nose into the private sector or an example of democratic government looking out for the little guy?

It depends on whether you are speaking to the Suffolk County (New York) Legislature or the Long Island Association, a business group in the county.

The point of contention is a resolution that regulates the use of video display terminals, which the Suffolk County Legislature passed last May. The bill mandates that employers with 20 or more VDTs meet certain ergonomic standards in the workplace, provide time away from the screen for terminal operators, and cover 80 percent of the cost of VDT operators' eye exams and prescription glasses.

Among other provisions,

the bill calls for indirect lighting in VDT operating areas, detachable keyboards, and a 15-minute break for every three hours of continuous VDT operation (the 15-minute break is to be spent performing other tasks). The bill also protects workers from losing their jobs if they file complaints or testify against their employers in cases of alleged violations.

But a funny thing happened on the bill's way to becoming law. The Long Island Association announced in late June that it is filing a suit in an effort to kill the bill.

In a prepared statement, LIA President James L. Larocca said: "The unique local VDT law is not only bad public policy because it singles out Suffolk County, but it is also bad law." The association believes the law will chase businesses out of

Suffolk County, an LIA spokesperson says. And from a legal standpoint, the association charges that the legislature is in violation of the New York State Municipal Home Rule Law, which says that county law cannot exceed state constitutional authority.

Until a judge reaches a decision, the bill is in limbo. The LIA spokesperson predicts it will be a lengthy battle.

—Susan Jelcich



Fly the Playful Skies

If you fly on a certain Canadian Airlines DC 10-30 this fall, you may partake of an electronic entree—or, rather, Entray, a small battery-operated computer game system built into the plane's meal trays.

The system, developed by Air Video of Toronto, consists of a 3-by-4-inch, flush-mounted liquid crystal display and a touch-sensitive control panel with a pad of cursorlike arrow keys.

Players can choose from backgammon, chess, blackjack, bridge, cribbage, or an adventure and murder mystery game that can last as long as eight hours. For now you can play only against yourself—a two-player option is in the works.

Air Video manufactures the complete game and tray system. The airlines decide whether to charge passengers for games.

The company is also developing programs for children. The younger set will be able to select from reflex games and educational games, such as spelling bees, to keep them occupied and learning, says Barbara Ivan, Air Video's vice president of public relations and marketing.

In the middle of a tense backgammon match when dinner arrives? No problem. "The meal may be placed right on top of the game, which will then go to 'sleep,'" Ivan explains. "After dinner, just press the On key, and the game will resume where you left off."

As of this writing, Entray is noiseless; you won't be subjected to the incessant beeping of most electronic games. When the games do incorporate sound, Ivan assures us, headphones will control the noise.

If you're not planning a trip in Canada but still want your in-flight computer games, don't worry. Air Video has been negotiating with airlines worldwide.

—Jane Hallisey



Color Comes to PostScript

You knew it would happen. You just hoped it wouldn't be this expensive. QMS, Inc., has merged the power of the PostScript page description language with the glory of color to bring you the ColorScript 100. All for the low, low price of \$24,995.

ColorScript 100 is a thermal transfer printer, meaning it uses heat-sensitive ribbons to put words and graphics on the page. Depending on the ribbon, you can get up to seven colors (red, green, blue, yellow, cyan, magenta, and black) plus white on paper or transparency film. It's great for people who need snappy visuals for dog-and-pony shows.

PostScript, developed by Adobe Systems of Mountain View, California, interprets for the printer the page design created on-screen. Until now, PostScript had been used primarily with monochrome laser printers.

The ColorScript 100, equipped with 35 standard typefaces, supports downloadable fonts. Output resolution is 300 by 300 dots per inch, which QMS de-

scribes as *near* typeset quality. You wouldn't want to take this to the printer, but you can get a fairly accurate color check of files that will be professionally printed later. And you can definitely produce classy newsletters and attention-grabbing presentation aids.

The printer has a recommended duty cycle of 4,000 prints per month. Each ribbon costs \$95 (\$300 for a pack of four) and can produce 180 letter-size pages in four colors, 210 in three colors, or 540 in black. If the ColorScript 100 were used for four-color printing at its maximum level, the ribbons alone could cost approximately \$1,800 a month.

Who has this kind of cash for a printer? "Graphics design firms and large corporations who have in-house graphics departments," says Bob Owens, advertising manager at the Mobile, Alabama, company.

As of this writing, about 50 companies have parted with their hard-earned dollars since the ColorScript started shipping this spring.

—Jane Hallisey



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"I first became acquainted with TOPS[®] when one of my friends in R & D gave me a copy of it. I brought it home, connected my Macs and PCs, and really liked it. At that point I became a fan... Now we use Tops in work groups throughout the office."

"One of the big advantages of TOPS is that it actually makes connectivity between different operating systems pretty simple. Macs and PCs can be connected using simple phone wire, and you can also connect to Sun[™] workstations."

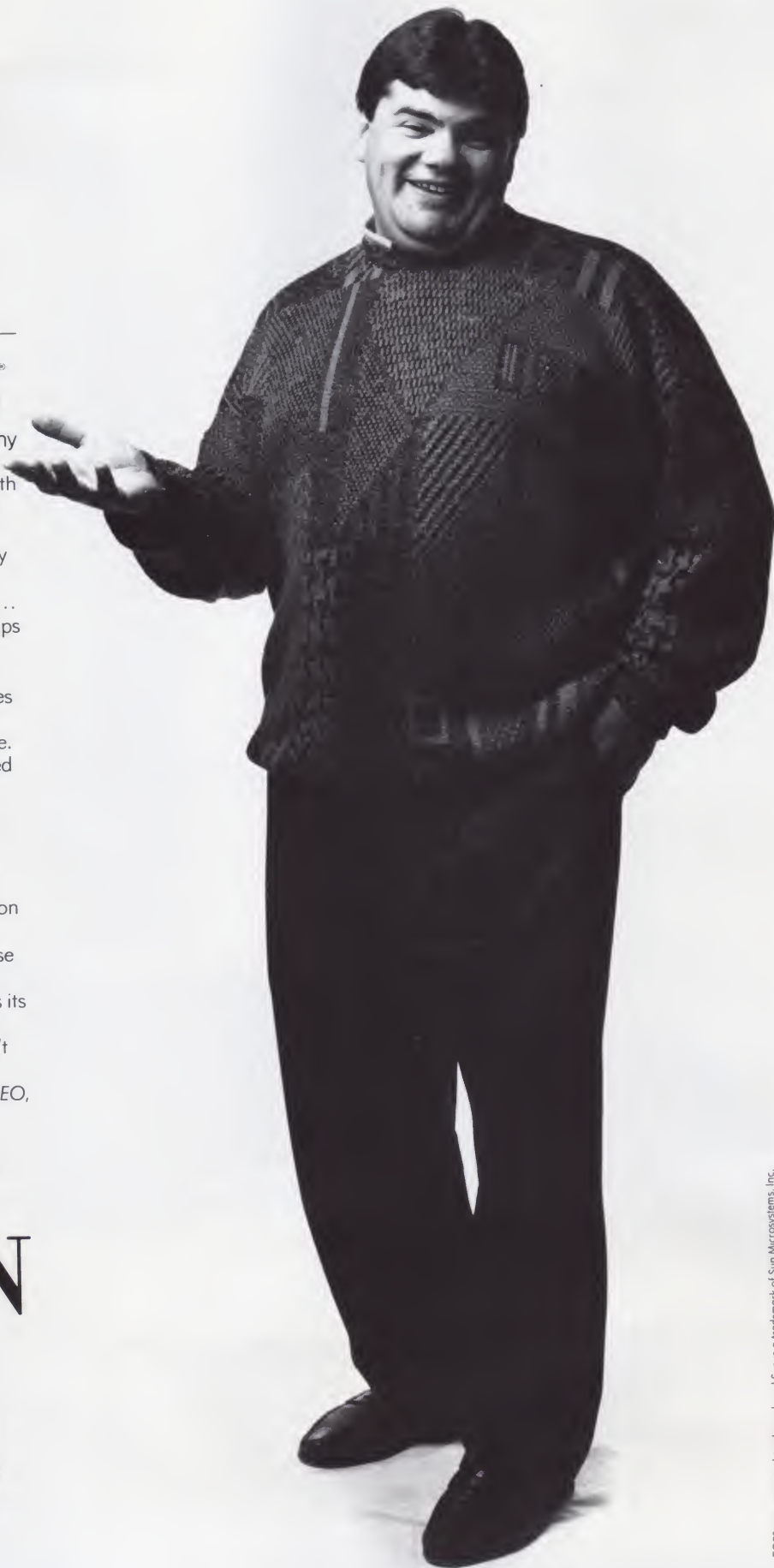
"We use TOPS with our multi-user database manager, Paradox[™]...and the LAN version of our spreadsheet program, Quattro[™]. We love its ease of use and intuitive interface."

"But even more important is its pricing edge. I think TOPS is a great idea. I'm surprised I didn't come up with it myself."

— Phillippe Kahn, Founder & CEO,
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Color on Your Lap

If you're a laptop user, there may be color in your future.

Two companies—Hitachi America and Planar Systems—are using different technologies to develop screens that will allow laptops to sport full-color displays within the next 18 months.

Hitachi may be the first to bring color to your lap; officials there expect to have a marketable color screen by the end of next year. Hitachi's approach: a color version of the liquid crystal display (LCD) screen often used in laptops.

Hitachi already uses color LCDs, reports product manager David Ross, but only on the 5-inch-diagonal television sets it sells in Japan. The company recently showed off a 6.3-inch-diagonal version of the screen, and it has started developing a 10-inch version as well. Laptop makers may start with the 6.3-inch screen, says Ross, and then turn to the larger version when it becomes available.

Further away from a product introduction is Planar Systems, which developed a color flat-panel electroluminescent (EL) screen. The basic difference between the two types is that LCDs work by reflecting

light, while electroluminescent screens emit light.

Like Hitachi, Planar plans to sell its screen to laptop makers. Rolland Von Stroh, vice president of marketing, doesn't expect them to be widely available on laptops until sometime in the early 1990s.

As one might expect, each of the two companies is critical of its rival's approach to laptop color.

Hitachi's Ross says EL screens will cost more than LCDs and require more voltage to run—a distinct disadvantage for a battery-

powered laptop. He adds that with EL technology "the colors will be off, especially the blue."

Planar's Von Stroh counters that "LCDs are lacking in visual performance because they just reflect light, rather than emit it; they have a fuzzy glow." EL screens, he believes, provide a higher contrast and have a faster response than do LCDs.

Until the screens are available, you can't test the companies' claims, but in the meantime you can listen to the war of words that will almost certainly erupt as the products come closer to reality. —Preston Gralla

Running on Empty

You may have a binder-sized buzz saw that packs the punch of an AT, but what do you do when your battery dies at 35,000 feet?

Traveling Software of Bothell, Washington, comes to the rescue with Battery Watch. A pop-up program that keeps track of the juice in your laptop's rechargeables, Battery Watch uses only 10K to 20K of memory, depending on the model of computer.

Traveling Software president Mark Eppley came up with the idea of a gas gauge for laptop batteries when his Zenith pooped

out 40 minutes into a flight to Germany. "I was told it was fully charged when I left," he says.

With nothing else to do for the remainder of the eight-hour flight, Eppley took his computer apart, hoping to find some clue as to how he could monitor the battery. "I had parts on all the seats around me," he recalls. "The flight attendants thought I was crazy."

When he returned to his office, Eppley and his staff continued to dissect his Zenith until they developed the logic that enables Battery Watch to perform more sophisticated monitoring than the low-battery light. Battery Watch keeps an eye on the "Estimated Time to Empty."

Battery Watch also offers a deep-discharge option to drain and recharge a laptop's batteries automatically. This prevents the "memory effect"—a characteristic of nickel cadmium batteries that slowly reduces their charging capacities. After one to three deep-discharge cycles, the battery is restored to its original capacity.

The \$39.95 package can be configured to work with most popular laptops, including those from Datavue, Epson, IBM, NEC, Sharp, Tandy, Toshiba, and Zenith. Traveling Software is developing configurations for other models.

—Doug van Kirk



PHOTO ILLUSTRATION BY JOHN VAN HAMMERSVELD

Do the Laptop-to-PC Shuffle

Manufacturers' claims aside, laptop computers have always been great for procrastinators. Admit it: most of you laptop users return to the office after a week-long road trip and secretly rejoice that the time-consuming laptop-to-desktop file transfer offers a terrific excuse to pour a cup of coffee and catch up on office scuttlebutt.

Not anymore. New and upgraded software makes data transfer speedier than ever.

Packages for plain-and-simple data transfer cost less than \$100. Rapid Relay, from Systems Management Associates of Raleigh, North Carolina, sends files between a laptop and a desktop model at a sizzling 115,000 bits per second. It's easy to run—we did it without looking at the manual—and lets you drive transfers via keyboard commands or batch files.

LapLink, from Traveling Software of Bothell, Washington, communicates at the same rate, but it includes a file manager and can be used to back up hard disk files. It's also more expensive: \$129.95. A handy feature is the cable, which includes both 9-pin and 25-pin attachments.

The Flying Dutchman, from Cyco International, zips information across the wires at 280,000 bps—more than twice as fast as Rapid Relay and LapLink. It obtains its speed by using parallel, rather than serial, communication ports. The product's catchy name derives from its manufacturer's Netherlands headquarters (its U.S. operations are based in Atlanta). At \$99, its price is catchy, too.

White Crane Systems' The Brooklyn Bridge, an early entrant in the field, came out in 1986 and made a quick showing before faster, easier-to-use packages eclipsed it. The Norcross, Georgia, company has dusted off the program and this summer introduced version 2.0. The upgraded program moves information at 115,200 bps and includes a file manager and a Lotus-like menu. The Brooklyn Bridge—so named, rumor has it, because its inventor always wanted to sell the New York City landmark—also lets the laptop and desktop share peripherals and form a kind of mininetwork. The only catch is that users can't stray too far: the basic package (\$139.95) includes only eight feet of cable; an additional 50 feet costs \$30.

Each transfer kit includes cables and two copies of the software, one on a 5¼-inch diskette and the other on a 3½-inch diskette. To get up and running, all you do is connect the two computers and run the programs on each.

So say good-bye to data transfer coffee breaks.

—Debbie Asbrand



No Questions Asked—Really!

Here's one from the too-good-to-be-true department.

Microsoft is offering you a win-win guarantee on its PC Excel spreadsheet. "Excel," a Microsoft ad boasts, "will outperform any Lotus spreadsheet. Or your money back. From now until January 1990."

Sure.

Plunk down \$495 for Microsoft Excel now, use the thing for a while, then get the \$495 back if someone comes up with a spiffier spreadsheet? I can even get my money back if I get bored with it? Hard to believe.

But that's what Microsoft is promising. "If you are unhappy with Excel in any way, shape, or form, we'll give you your money back," spokesperson Marty Taucher says.

Just go to your dealer or directly to Microsoft, and come away with your \$495. No questions asked.

"We're so confident about Excel that we don't think people are going to return it," Taucher says. —Jane Hallisey

PCs in the Palm of Your Hand

They're rough, tough, and make even the smallest laptops look oversized. They pack enough memory to run almost any kind of software. And, their creators want you to know, they're ready to take on the nastiest of jobs.

They're handheld computers, PCs that weigh as little as a pound and are designed for specialized field applications.

Despite their size, handheld PCs are being marketed with a decidedly macho image, as if their smallness leaves them with Napoleonic complexes. One company brags that its offering allows you to "get computers out of the office, and out on the front lines." Another firm features its machines in traditionally manly settings like construction sites, auto repair shops, police cars, even atop military tanks. The name of a third company's product, Husky, leaves no doubt that although the computer doesn't weigh much, it's no lightweight.

In general, handheld PCs are made for computing in the field, and they usually run custom software rather than off-the-shelf programs. Loggers, for example, are using them to figure out the most efficient ways to cut lumber. Handheld computers have been around for a while, of course. What distinguishes these newer models is that they pack more power, and many are DOS compatible.

Typical of the new crop is Paravant Computer Systems' RHC-88, a 4½-pound machine the size of a hard-cover book, with 512K of main memory, a 5-by-2¾-inch backlit LCD screen, and communications ports. Its rugged design meets military standards, and it runs most DOS programs.

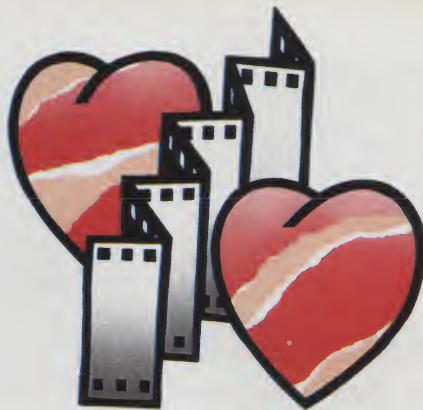
But don't expect to bang out your novel or run Lotus 1-2-3 on this machine. Its keyboard is calculator-like, and its tiny screen would frustrate the most patient user. Nor does the RHC-88 come cheap; it costs \$3,995, to be exact.

Husky Computers offers a whole line of diminutive PCs. And Micro Palm Computers offers a handheld product with memory modules expandable to 2.2MB.



Paravant puts a PC in the palm of your hand.

—Preston Gralla



Cure for Ailing Romances

Having compatibility problems with your lover? Take heart. In fact, take Heart-to-Heart, "a tool couples can use at home ... to find more joy and sat-

isfaction in their relationships."

Developed by InterActive Software of New York, Heart-to-Heart is intended to open up communications between partners. The program first asks each partner about 180 multiple-choice questions (patterned after the ones used by practicing therapists).

Heart-to-Heart then leads troubled lovebirds through an "intimate communication session... to improve and expand their relationship." Partners read and react to statements issued by the computer based on their questionnaire responses, as the program prompts them to elaborate their feelings.

At \$49.95, it sure beats a marriage counselor.

—Marty Jerome

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When a new kind of software is released, some explaining needs to be done. In the case of IZE, a quick demonstration is the best explanation.

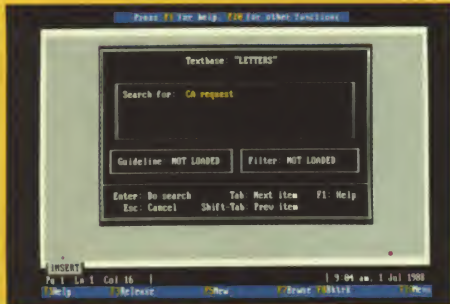
Picture an executive opening her IZE and requesting an outline of letters re-

sponding to inquiries for information written to contacts in California. Based on the request, her complete collection of letters is searched. IZE finds 190 information response letters to addressees in California.

From the IZE outline, our executive can quickly find what she needs. An in-depth outline guides her to precisely what she is looking for. One keystroke presents the letter she was seeking. It's now simple, using IZE word processing features, to customize the letter she found for the current task.

A call brings a request for some sales projections. IZE will find them fast even in other applications.

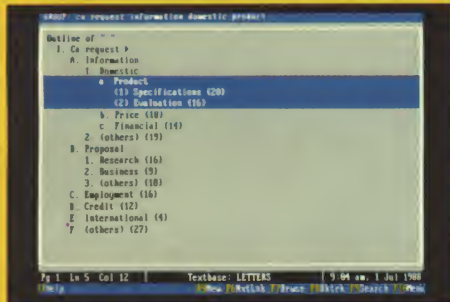
The executive simply hot links directly from IZE to a spreadsheet document. The figures are found and the executive gives it a final



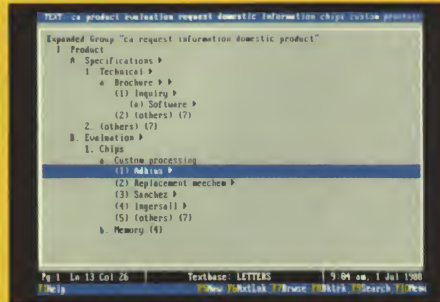
0:00:05 With IZE open, a request is made.



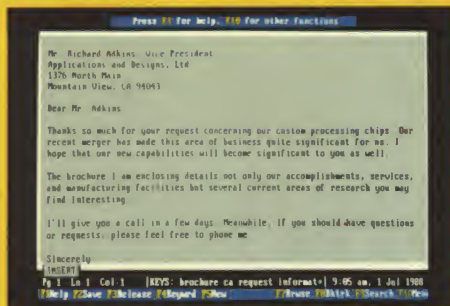
0:00:17 In seconds, IZE organizes the facts.



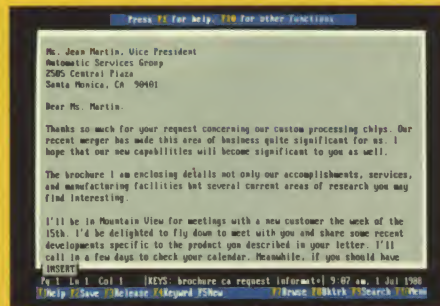
0:00:24 An outline appears to scrutinize.



0:00:35 The outline expands to sharpen focus.



0:01:01 The facts are found ready to revise.



0:03:20 A new, customized letter is ready to print.

the question answered. Returning to the customized letter, the question answered. Returning to the customized letter, the question answered. Returning to the customized letter, the question answered.

If these 3 minutes and 20 seconds of productivity are something you'd like to see more of, don't waste time before taking the next step.

Visit a dealer for a longer demonstration or phone us at 608-273-6000 and realize the power of IZE.

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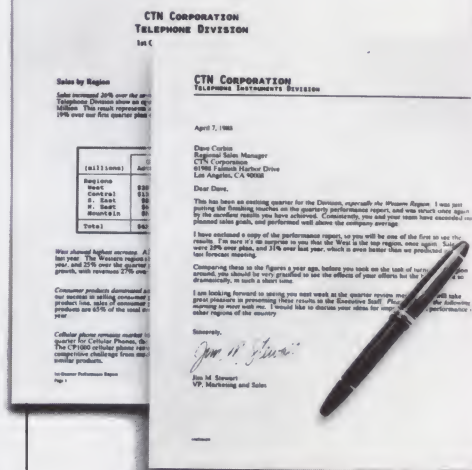
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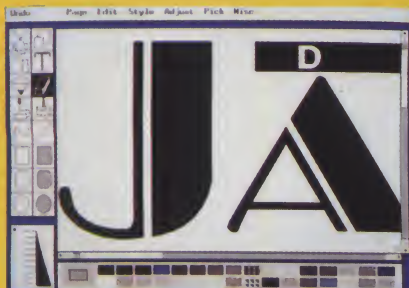
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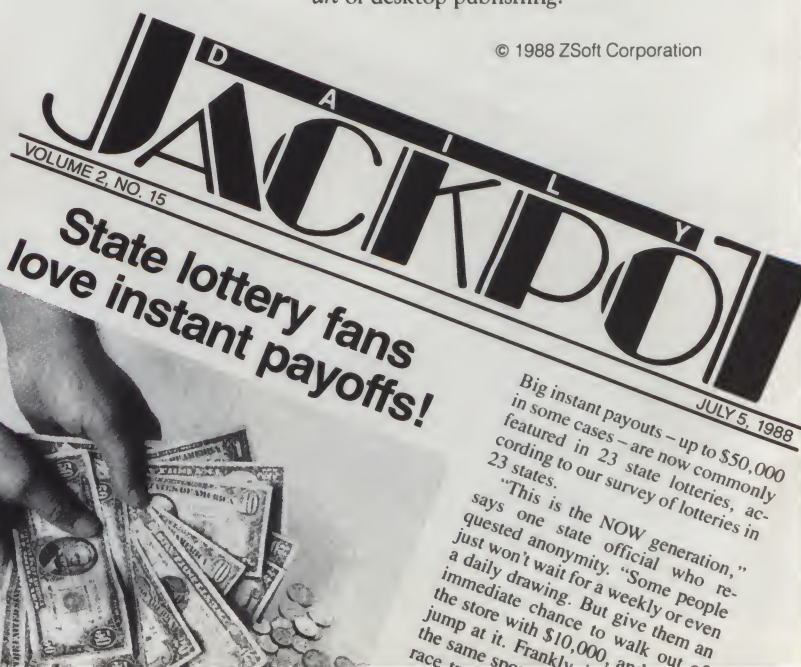
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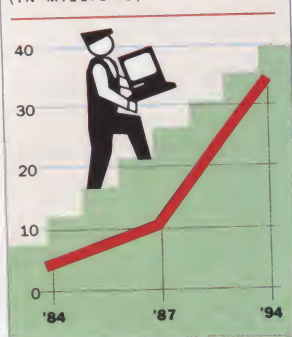
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Where the PCs Are

CHARTS BY NEIL PINCHIN

PC growth in the workplace
(IN MILLIONS)



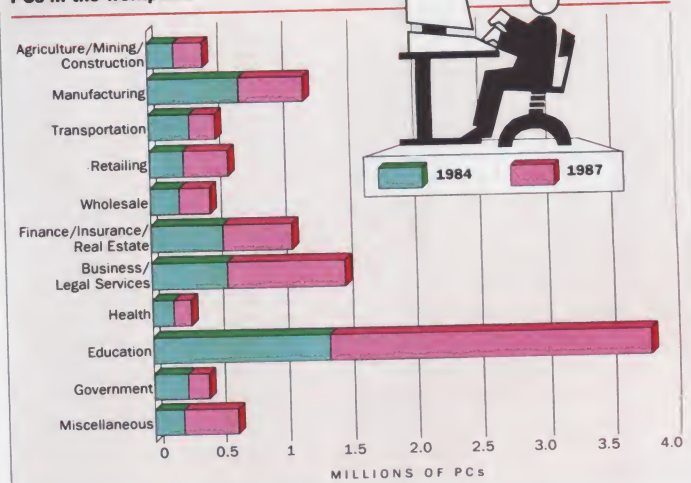
How many PCs are in the workplace? Fewer than 11 million, reports ComTec, an industry research division of the Gartner Group in Stamford, Connecticut.

But those numbers, which analyst Gilbert Heath concedes are conservative, are about to skyrocket. In seven years, the PC population at work should grow threefold to some 34 million, he says.

All this makes Heath especially bullish about the future health of PC-related industries. "The market is 25 percent penetrated," he claims. "That means 75 percent of workers are still waiting to get PCs."

—Ann Sussman

PCs in the workplace



Help Wanted

Paralyzed at the thought of finding your first job? Bored with the job you've got, but don't know how to look for a new one? You're a candidate for Career Navigator, developed by career counseling and outplacement experts Drake Beam Morin, Inc.

The software takes you by the hand and teaches you how to assess your skills, develop career objectives, write resumes and cover letters, interview—in short, how to conduct a thorough and organized job search. Once you land the job, Career Navigator will even help you evaluate it.

The program, endorsed by the College Placement Council, was initially tested by more than 600 job-seeking stu-

dents at colleges and graduate schools. The published version incorporates many of the suggestions received from the students and their placement counselors.

Barbara Reinhold, director of career development at Smith College in Northampton, Massachusetts, says of Career Navigator, "We've been very pleased. I'm particularly impressed with how the self-assessment test is used with the job search."

Career Navigator is ideal for first-time job seekers or anyone without much job search experience, says Dr. Marcia Fox, senior vice president at Drake Beam Morin in New York. You'll need an IBM or compatible PC, DOS 2.0 or later, and 2MB of disk space to get started. A color monitor and letter quality printer complete the system. You can order Career Navigator, which retails at \$129, by calling (800) 345-JOBS. Special discounts are available to educational institutions.

—Jane Hallisey

Tallgrass Returns

Tallgrass Technologies, a seven-year-old company in Lenexa, Kansas, was once synonymous with tape backup. The company jumped to the fore of the tape drive industry, developed a solid product line, and carried the banner for standardization. Like every other tape drive company, Tallgrass wanted its method to become the industry standard.

Then Tallgrass got lost in the weeds. Product delays, increased competition, and overexpansion took their toll on the young company and its leader, Dave Allen. The board of directors intervened and installed a new president and CEO, David Horton, an executive with years of experience in

technology companies. Horton gave the company direction, consolidated its product lines, and sold off its network business to raise cash for product development.

This summer Tallgrass emerged from its quiet renaissance and is "back in the backup business," says Horton. His statement is underscored with three new products—two for IBM compatibles and one for the Apple Macintosh.

The two IBM-compatible drives—the 40MB TG-1140 and the 150MB TG-1500—can be configured to work with both PCs and PS/2s. Both include error



correction capabilities and come with a three-year warranty. And the two drives can take advantage of extended-length data cartridges to get an extra 20MB and 100MB of storage, respectively.

At \$495, the TG-1140 backs up data at 2MB per minute. The TG-1500 does backup at 5MB per minute; it costs \$1,595 for the internal configuration and \$1,795 for the external model.

The \$1,195 TG-4000 is Tallgrass's first foray into the Apple field. The 40MB

tape drive can be configured with an optional 40MB or 100MB hard disk, at \$1,195 and \$1,995, respectively. (If you buy the tape drive preconfigured with the 40MB hard disk, however, the cost is \$2,495.) The TG-4000 also carries a three-year warranty.

—Chris Shipley



Food Fight

Health aficionados take note: you need never again worry about the fat content of that Big Mac or quart of Häagen-Dazs. Dietary analysis software will feed your pursuit of the perfect body—or garnish your guilt.

Dietary analysis programs start by asking you a few ques-

tions about your sex, height, weight, age, level of exercise activity, and how much and what kind of food you eat daily. The software adds up calories, breaks down foods by proteins, fats, and carbohydrates, and then tells you how your

daily bread stacks up against nationally published daily nutrition requirements.

Nutrisoft's Nutri-Fit is designed to track dietary habits for a family of up to five. The program rates your diet on 38 essential nutritional elements and compares this analysis with accepted guidelines. Low in vitamin E? Nutri-Fit tells you which foods are rich in E or any vitamin. Worried about cholesterol? The \$49.95 program ranks foods from highest to lowest levels.

Diet Analyzer, a \$49.95 program from Natural Software, looks for 24 nutrients in your daily repast and lets you rate physical activity against more than 100 listed exercises. The program's database holds nutri-

tion information on 1,000 foods, but with 640K of memory and a hard disk, you can add up to 4,000 favorites.

For \$99.95, you'd have to be more than a little bit curious to pick up Nutrition Wizard, offered by the Center for Science in the Public Interest. The program does have an extensive database of foods—1,849 in all, including about 500 fast foods and 400 brand names—which is expandable up to 9,000. Nutrition Wizard makes recommendations on 34 dietary factors including alcohol, refined sugar, and caffeine, but it doesn't account for physical activity, as the others do.

—Traude Gomez

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19:56 01/03/87 CHANNEL 05
CREDITED Bkuser 211768 (PAID)
03:06 01/04/87 3AM CLEANUP
DELETED Freebie (Cr: 0)
09:08 01/04/87 MAIN CONSOLE
DELETED Pestuser (Cr: 0)
09:16 01/04/87 CHANNEL 07
XF 10600 Stryker->Ozone
09:31 01/04/87 MAIN CONSOLE
CREDITED Jbond 36000 (PAID)
09:32 01/04/87 MAIN CONSOLE
CREDITED Rmcnamara 18000 (FREE)

```

Users

	(0)	(1)	(2)	(3)
0 Tiponeill
1 Ozone
2 SIGN-UP
3 Lori
4 LOG-ON
5 Rmcnamara
6 Majik
7 Stryker
8
9
A
B
C
D
E
F

monitor	send
display	post
detail	set msg
emulate	
analyze	kill

09:35 01/04/87
UsedYTD: 84 hr
Accnts: 1553
Spaying: 482

Commands

display number of paying accounts, in position 3
post 36000 PAID credits to User-ID: Jbond
post 18000 FREE credits to User-ID: Rmcnamara
emulate channel no. 3

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CIRCLE NO. 253 ON READER SERVICE CARD.

Mouse Chaser

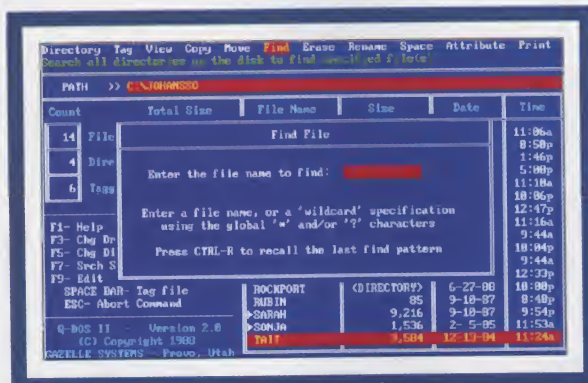
What's faster than a mouse, more accurate than a trackball?

Developers at Lightgate, Inc., call it Felix, a pointing device introduced earlier this year and improved in its current 2.0 version.

The anatomy of this mouse chaser puts it in a computer accessory class by itself. Felix is a 6-inch-square plastic block with a recessed 1-inch square in the center. A small rectangular handle, held between thumb and forefinger, works as the pointer.

The inset square represents your entire PC screen; the position of the handle—or pointer—in the square corresponds to its relative position on screen.

Using Felix's pointer is



much like using a pencil, say officials at the Emeryville, California, firm. You don't have to move your arm and shoulders as you do with a mouse, which makes Felix faster than its rodent counterpart.

Twelve programmable

"hotspots," evenly spaced around the edge of the inset square, are designed to activate commands, text, and keystrokes commonly used in an application. To execute a command, simply move the pointer to a hotspot and press the button on the knob. Hotspots can be used to load macros, for example, or to invoke a

precision mode, changing the inner square so that it represents only half or one-fourth of the screen—an excellent idea when you need magnification for drawing fine details.

Felix, priced at \$199, comes with software drivers, including several functions developed for Lotus users. The driver programs one hotspot, for example, to display a window with commands for undoing up to 12 previous spreadsheet changes.

The driver software also emulates a Microsoft bus mouse and supports popular applications including AutoCAD, Windows, Excel, and PageMaker.

—Don Trivette

Herculean Effort

Hercules Computer Technology hopes to make the pairing of network adapter and monochrome graphics on a single PC expansion board as familiar as a one-two punch, ham and eggs, or Scotch and soda. Start with two or more Network Cards, run the TOPS software that's bundled with them, and you'll have an easy-to-use home or workgroup computer network.

The Hercules Network Card Plus saves you a slot in your PC and the greenbacks you'd otherwise pay for hi-res video. Because it conforms to the AppleTalk standard, you can filch the twisted-pair wiring you need from your telephone and connect any device that has an AppleTalk jack on the back—including a Macintosh.

On the downside, the Hercules board saddles you with a video standard left over from the lost generation of computing and a network that slugs along at 230 kilobits per second. At \$369 per board, the Network Card Plus isn't cheap, but it makes a serviceable all-in-one computer link.

—Winn L. Rosch

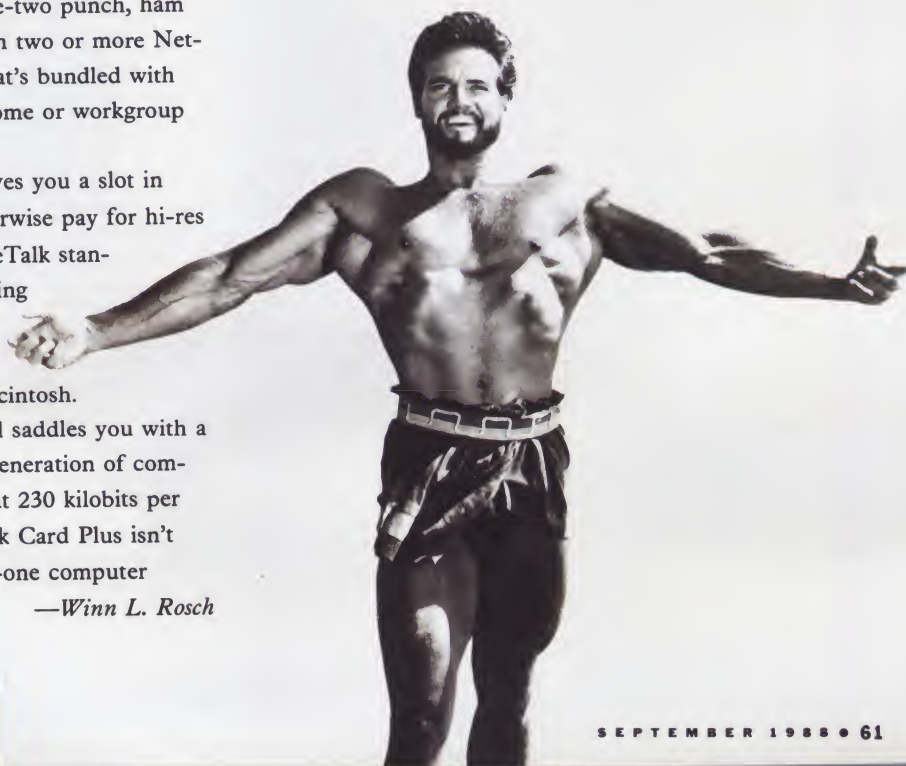


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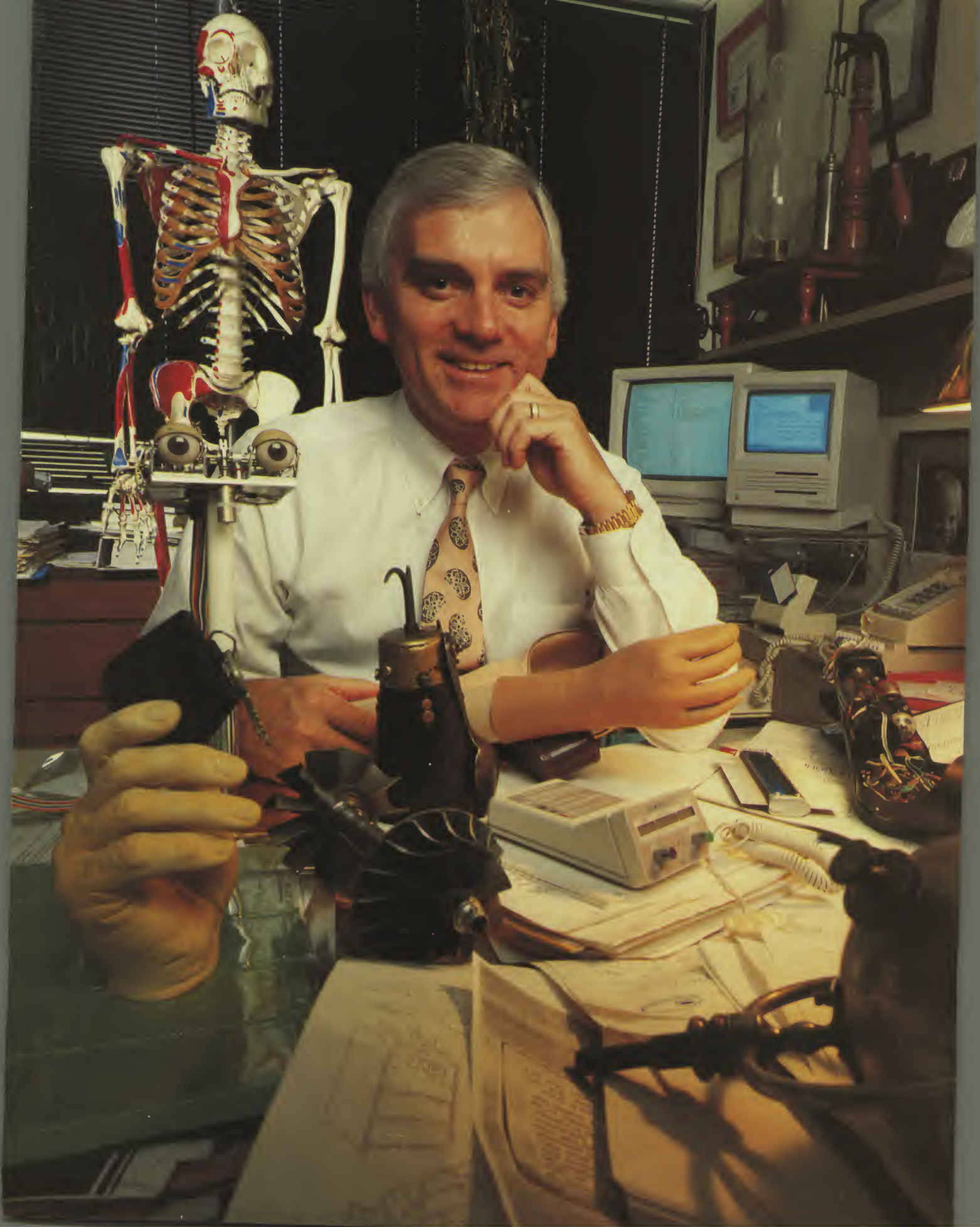
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HOPE & GLORY

Men, Medicine, & PCs

The artificial heart was just the beginning...

By DAVID DEJEAN

The advance of knowledge: Professor Stephen Jacobsen, who helped design the original artificial heart, now runs his own lab, tackling biomedical engineering problems.

The Compaq Portable II sits on top of the controller console for the Jarvik-7 artificial heart. It is probably the most romantic use for a personal computer in the world.

But that isn't really what this story is about.

It's about science and magic and how we make our myths. This is a story about doctors on the cover of *Newsweek*, and a list of patients whose names ring in memory like those of astronauts: Barney Clark, Bill Schroeder, Murray Haydon, Jack Burcham.

It's also a story about the years of hard work behind the magic, and the people who didn't make *Newsweek* but have continued to carry the work forward into new areas of knowledge.

And, of course, it's a story about computers, because these days computers are part of every story.

Salt Lake City is a fooler. It looks small against the distant foothills of the Wasatch Range of the Rocky Mountains, but it's a sizable place with an aura of success, and an anything-can-happen frontier spirit mixed with the no-nonsense industriousness inherited from its Mormon founders. Its streets were laid

of those companies is located northwest of downtown, near the capitol, in an old hospital building. Here Symbion, Inc., manufactures the artificial heart.

The glory days for Symbion began on December 2, 1982, when a surgical team headed by Dr. William DeVries implanted an artificial heart in Barney Clark.

The company that had made the heart was then called Kolff Medical. Dr. Willem Kolff was already famous as the inventor of kidney dialysis when he came to the University of Utah medical school in 1967. There he established the Artificial Heart Research Laboratory under the wing of his Institute for Biomedical Engineering, as part of his research into

raised \$22 million in a public stock offering.

In 1984 Dr. DeVries moved to Louisville to work at the Humana Heart Institute. He quickly performed three more implants in late '84 and early '85. Although the artificial hearts functioned flawlessly, complications from the implant surgery, including clotting, bleeding, and infections, felled all of the patients.

Since then the artificial heart has been used frequently, not as a permanent replacement for the human heart, but as a bridge to a transplant, a temporary measure to keep a patient alive until a donor heart becomes available.

There are 40 medical research centers equipped to implant the Jarvik-7

Symbion, the manufacturer of the artificial heart, is one of the oldest and most famous companies born of the University of Utah's technology-transfer program.

out with a compass so that any address is a set of coordinates, easy to find. At the center, in Temple Square, is the Mormon Tabernacle. North is the state capitol. Due east, up the first slopes of the mountains, is the University of Utah.

These three pivot points of the city—religion, government, and education—have done much for it. The Beehive State has made its university a place of preeminence, especially in the practical sciences of medicine and engineering. And the university in turn has given back to the state economy a flock of companies built around technology developed by university staff and laboratories. In recent years the careful husbandry of the university's "technology transfer" program has created Research Park, a high-technology office park just south of the campus, and scattered more companies and licensees across the city and the country.

One of the oldest and most visible

the development of artificial organs.

In the late 1960s the AHRL was under the direction of Clifford Kwan-Gett, a surgeon who had come to the university with Dr. Kolff. The AHRL designed the artificial heart, tested it in animals, and redesigned it until it took the shape it has today: a total heart replacement implanted in the body and powered by compressed air delivered by tubes that pass through the skin. An external console controls the pneumatic action of the heart. Diaphragms relax to let the heart's chambers fill, then expand under pressure to force the blood from the right side of the heart toward the lungs, and from the left out into the body.

The AHRL hired Robert Jarvik as a design engineer in 1971. A decade later, in December 1982, William DeVries made history by implanting a Jarvik-7 made by Kolff Medical in Barney Clark. Clark lived for 112 days, and the eyes of the world were turned on Salt Lake City.

The following year, Kolff Medical changed its name to Symbion and

heart or a ventricular-assist device that is based on the same technology but doesn't require the removal of the natural heart. By this summer, 106 Jarvik-7s had been implanted as temporary measures.

With artificial-heart prices at \$20,000, controller consoles at \$75,000, and an expanding line of related products, Symbion is a thriving business. Its corporate offices and labs occupy a newly refurbished building that used to be nurses' quarters for the old St. Mark's Hospital. Here, parts inventories are tallied, developers labor over documentation and CAD systems, a huge milling machine grinds out molds for the heart chambers—and in one small room, some three dozen artificial hearts and ventricular-assist devices pump away in endurance tests. The room pulses like the sound track of a cheap horror movie. The *lubLUB, lubLUB, lubLUB, lubLUB* fosters an uneasiness that is curiously intensified by the knowledge that these are robot organs, not real ones.

In the room next door, a Symbion

David DeJean is a senior editor of PC/Computing.

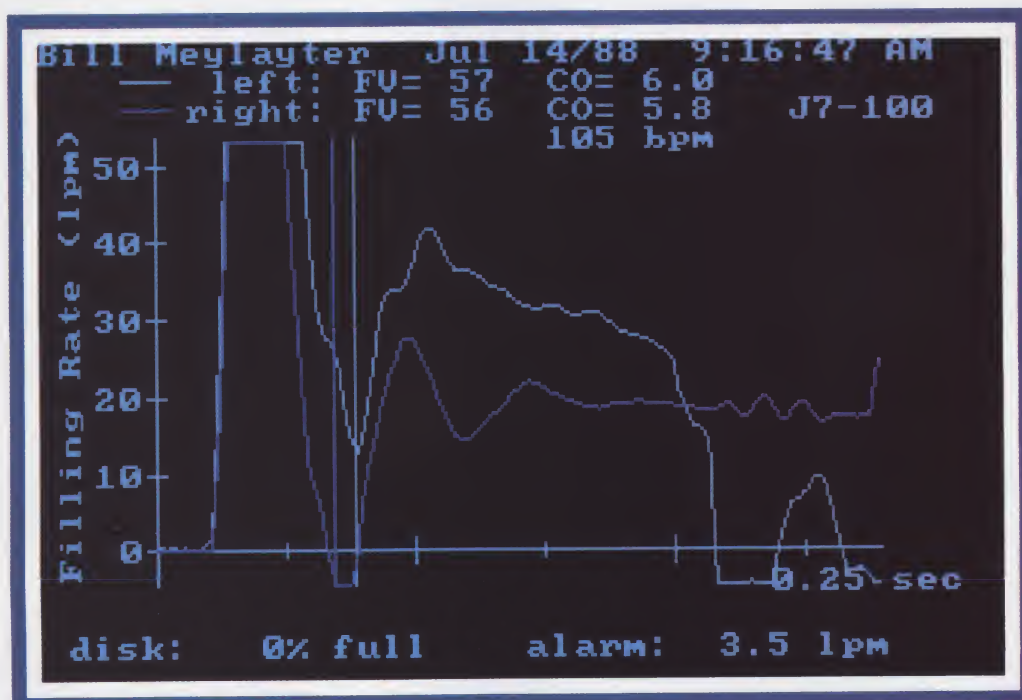
Circulatory Support System Model III E—a controller console—is hooked up to an artificial heart. The heart circulates water through a plexiglass structure that approximates the volumes and pressures of the human circulatory system.

The controller is a chest-high metal cabinet whose front panel is lined with dials and gauges and alarm indicators. Inside is a plumber's nightmare of pipes and gizmos, emergency air tanks, and backup batteries. On top sits a Compaq Portable II computer. It is running a program called Comdu—for Cardiac Output Monitor and Diagnostic Unit—which monitors airflows and pressures in the pneumatic drive lines leading to the artificial heart. The readings appear in graph form on the computer's screen.

The controller originally used an Apple II. After Barney Clark's surgery, the Apple was traded in for a Compaq Portable, and then upgraded to a Compaq Portable II with an 80286 processor. David Jones, the software developer who maintains Comdu at Symbion, likes the resulting speed improvement. "With the 286 the [Comdu] program runs a lot faster. I used to hit a button and wait. With this machine it comes right back." The Comdu program is getting better, too. It's all custom code, and the current version is written in Microsoft C. ("I'm stamping out assembler," says Jones.)

The Portable II isn't the same Compaq you could buy off a showroom floor, but it wouldn't be hard to put together. It comes with

two 360K 5¼-inch disk drives. The Comdu program can save a data history to disk at one-minute averages or beat by beat. The low-capacity drives can hold four or five days' worth of typical data, says Jones—and they're relatively klutzproof. So is the Comdu software: it's write protected, though not copy protected. It was once copy protected, but the protection scheme wouldn't allow the disk



The graph drawn by the Comdu program has a line for each side of the heart—a "primitive" use of computers, but effective nonetheless.

to be write protected, and too many doctors wound up reformatting their program disks.

Inside, one of the Compaq's expansion card slots holds a Hayes 1,200-bps modem, which gives the system some remote dial-up capability for monitoring and system diagnostics. In the other slot, a Data Translation 2801 board provides analog-to-digital and digital-to-analog data conversions to measure air volumes and pressures and run some indicator lights and alarms on the controller.

The Compaq sits on top of the controller console so that it's easy to service and easy to move from one controller to another. Symbion equips each research site with two control-

lers but with only one computer.

The graph on the computer screen has one line for the right side of the heart, one for the left. The screen displays Filling Volume and Assist Device Output for both sides, as well as the pulse rate. Like an X ray or an electrocardiogram, the Comdu graph says nothing to the untrained eye. But to the surgeons and engineers who bring years of experience with animal and human patients to the display, it speaks volumes.

"The purpose of the display is to allow you to operate the heart so it automatically regulates the cardiac output," says Dr. Kwan-Gett, now medical adviser to Symbion. "The important thing is that you don't want the right heart to pump more than the

rolls over, and sleeps on it, the computer sets off an alarm. But you can also see it immediately on the waveform if the alarm doesn't go off.

"I remember back with the Barney Clark case it was discovered through the waveform that some blood had gotten onto the transducer in the air lines and was actually blocking the flow. That was fairly readily recognized from the waveform and corrected by cleaning.

"We've only had one case of a broken heart valve, and that was in Barney Clark, the very first patient. The computer was crucial there in assessing the function of the right and left hearts and allowed immediate adjustments to be made that saved his life."

Dr. Jarvik and Dr. Kwan-Gett are

"Later on, when the heart is fully implantable, I think you want the computer to adjust the output to match the patient's demands," says Dr. Kwan-Gett.

left can handle, because if you do you're going to overload the lungs. The computer allows us to adjust the left heart so that we won't get any lung congestion. Then after that it allows us to keep an overall track of the output on a beat-to-beat basis over a long period of time. In addition to that, there's some fine tuning. Driving the right heart, or driving both hearts, we can adjust the driving pressures, we can adjust the pulse rate, and we can adjust what we call the percentage systole-to-diastole ratio, or the on-time and off-time during each pulse. And you can kind of treat the system and optimize it so you're not overstressing the membrane that you're pumping, and hopefully by not overstressing you're doing less blood damage and promoting longevity. So by analyzing the various waveforms, the computer lets us optimize the driving conditions."

The basics are pretty easy to learn, according to Robert Jarvik. The computer "can assess whether there are certain simple but critical problems. Like if a patient kinks the air line,

just two names on a long list of people once at Utah, now scattered across the country, who contributed to a classic case study in innovation. Dazzling intellectual achievements in design and materials engineering, virtuosic surgery, brilliant advances in drug therapy, and the steady, plodding work of dozens of people—nurses in animal surgery, lab workers painstakingly layering polyurethane on heart molds, calf-sitters, software developers laboring to speed up code, machinists—enabled the team to put together a critical mass of ideas and technology.

And to do something that had never been done before.

The new St. Mark's Hospital occupies a square block considerably south and east of the old St. Mark's, having followed its patients to the suburbs. An imposing but budget-conscious temple of healing, with looming rough concrete slabs laced together by glass walk-

ways, it bears testimony to the new realities of health care.

Here Dr. Kwan-Gett practices cardiovascular and thoracic surgery—surgery on the heart, the major blood vessels, and the lungs. A compact man with a quiet manner, Dr. Kwan-Gett seems somehow out of scale with the new St. Mark's, mismatched with suburban medicine. He was Dr. Kolff's number two at the Artificial Heart Research Lab, and something of the laboratory, of research and academics, still surrounds him.

From the time the AHRL was founded in 1967 until he left in 1971, Dr. Kwan-Gett designed the early versions of the artificial heart, worked on the compressed-air systems that drove them, and led the surgical team that implanted test hearts in animals. Today, as medical adviser to Symbion, he trains the surgeons who come to Salt Lake City to learn the procedures for implanting the heart and the ventricular-assist device.

Dr. Kwan-Gett speaks of the artificial heart with a proprietary intensity. He bristles at the suggestion that it has proved unsatisfactory. "It depends on your terms of reference. I think the big problem with all the hype and publicity coming out of the university is that the University of Utah kind of presented this as a finished item, which was ridiculous. This heart essentially worked the same way as it did when it was first made, almost 20 years ago. It hasn't changed substantially at all. It has refinements. It clots less and is more reliable, but basically it is the same device as was the prototype, back when it was first made in 1969."

Because the university presented the heart as a finished item, he says, "the public expected the patients to be up walking around, feeling well. And relative to those expectations, I think, the public feels that the heart

Heart surgeon Clifford Kwan-Gett thinks premature publicity created unrealistic expectations for the artificial heart.

PHOTOGRAPH BY BOB SEIDEMANN



has been a failure, and not only the public but the scientific community. Had it been presented as a limited device, I think people would have been very happy with it.

"My real goal is to make one for permanent implant, so that when you put it in, it stays in and hopefully would work as well as or better than a transplant. Of course, we're a long way from getting to that goal, but that's the ultimate goal."

The Symbion heart's use of computers is "primitive," Dr. Kwan-Gett says. "You adjust manually approximately how you want it to pump and the computer keeps track of everything. But later on, when it's fully implantable, I think you want the computer to adjust the output to match

Lake City, and that's Homer Warner. He can really tell you a lot about computers in medicine. He's streaks ahead of us."

Dr. Homer Warner's office is tucked away in the basement of University Hospital. Its closed door is marked Medical Informatics. On the corridor wall is a display case containing a brief history of the Artificial Heart Research Laboratory, photographs of the eight artificial hearts that have been used clinically since 1969, and an outline of the seven patients who have received artificial hearts: seven sets of initials, each followed by the number of days

he wanted computers to help him to manage and interpret it. His work over the last two decades has pushed both medical and computer technology to new frontiers as he and his fellows have searched for more sophisticated tools: data-gathering instruments, very large databases, artificial-intelligence techniques, mainframe computers, and, recently, personal computers.

The first result was Help, a hospital information system that collects and categorizes patient data, then applies some artificial-intelligence principles to suggest interpretations of the data to the attending physicians and to monitor potentially life-threatening conditions. Help runs on Tandem mainframe computers and collects

The Center for Engineering Design is stuffed with computers—MicroVaxes, Sun workstations, Macintoshes—but Jacobsen is more interested in the results of his lab than in its tools.

the patient's demands, so if the patient is running or exerting himself the computer will automatically increase the output of the heart. Or when the patient relaxes, lies down, sleeps at night, the output can go down. The computer will monitor that and adjust the driving conditions."

The computer, he says, will be an essential component of that successful device. "It will be just like it is on pacemakers, for example. Regular cardiac pacemakers have a miniature inboard computer."

Dr. Kwan-Gett cites other applications of computers in medicine: "All our CAT scans, nuclear magnetic resonance stuff, all those are very highly dependent upon computers. And also for ultrasonic studies, for bone density, for kidney stones. And now they're starting to use them for automatic monitoring of blood glucose, automatic injection of insulin, that type of thing."

"Actually, if you're interested in computers in medicine, one of the world authorities in that is in Salt

the patient survived after implantation and the cause of his death.

It's odd that the display is located here. The Informatics department and the artificial-heart program have no direct connection, a point that Dr. Warner stresses early in conversation: "I have not personally worked on the artificial-heart project. We did a lot with patient monitoring and that sort of thing, but I don't want you to think that I was a prime mover in the artificial-heart effort, because I haven't really contributed there, I'm afraid."

But the intellectual links are there. Dr. Warner began his work on computer analysis of patient data in the late 1950s, as head of the cardiovascular laboratory at Latter Day Saints Hospital in Salt Lake City.

"Warner was one of the very first to get computers involved with medicine," says Dr. Kwan-Gett. "When I first came here, he was the one, for example, who used a computer to just look at the pulse waveform and from it try to get an estimate of cardiac outputs."

As Dr. Warner gathered more data,

data from all over University Hospital through a variety of interfaces, ranging from computerized instruments that analyze blood chemistry to patients sitting at terminals and entering their own medical histories.

"The system may look at blood-gas tests, for instance, and decide the patient has acute respiratory acidosis," says Dr. Peter Haug, also of the Medical Informatics department. "That information goes back into the patient's record, and the physician out on the floor knows what the computer thought."

The capabilities of the Help system and the name of the department Dr. Warner created point to his goal for computers in medicine. He defines "medical informatics" as the rearranging of medical knowledge in a form that will make it more useful for decision making.

"That involves a lot of things," he says, "not only building expert systems, but things like CAT scanners, where you're essentially taking information and with the help of a computer rearranging it so you can get

more information in a more useful form. You can see the brain or whatever structure you're looking at in any plane." Medical informatics has sprung up only very recently, "because of this powerful new tool we have to do this rearranging, which is the computer."

New computers mean new arrangements. Dr. Warner's latest project is a microcomputer-based system. Like Help, it involves patient records and expert systems. But this time the purpose is not clinical support but medical education. The system, which runs on a network of Macintoshes, is called Iliad.

"It's a way of rearranging medical knowledge again," says Dr. Warner. "The purpose of it is to try to convey that knowledge to medical students in a problem-solving setting." Iliad is an attempt to do nothing less than to automate the procedure that lies at the center of the practice of medicine: differential diagnosis.

Iliad makes a diagnosis just as a physician would: it elicits statements about a patient—symptoms, observations, test results—and draws a conclusion. The diagnosis is expressed in probabilities: "If the patient has symptoms A and B, then there is an X percent chance that the illness is. . . ." If a cough is the symptom, Legionnaires' disease ranks high on the list. A cough and a fever? The position of Legionnaires' disease on the list of possibilities drops dramatically. And as the system's knowledge of a patient's condition grows, the percentages of some probabilities rise.

Iliad moved out of the development phase and into the hospital wards this summer, with medical students entering patient information, comparing their diagnoses to Iliad's, following the system's reasoning process. The elements of that process are much the same as those of the Help system: patient data, knowledge base, data dictionary. But the interaction creates new challenges.

"Here the challenge is the man-

machine interface," says Dr. Warner. "How do you present that knowledge in such a way the student can digest it? And how can he move back and forth in it, how can you build the system so it understands what the student is telling it, and then how can it lead the student through that optimal path for working up a patient?"

"We settled on the Macintosh because it has such a wonderful interface. We didn't want to teach medical students about computers, we wanted to teach medicine to medical students. They can learn the Macintosh very quickly, and it's just a whole different world from the keyboard kind of orientation that other systems have."

Iliad stands on the shoulders of the Help system in another way as well: "We have a large database that we can use to derive any of these statistical estimates. We've got over half a million patients on that Help database."

The statistical orientation and the large database make Iliad a powerful teaching tool, but it has applications far beyond education. A computer system that can make diagnoses is a powerful idea: a rule-based system that never overlooks a relationship among symptoms, no matter how obscure, and that can see not just the number of patients one doctor can see in a lifetime but the volumes of patients that flow through a place like LDS Hospital. "We'll be able to provide services to some doctor practicing all by himself in some remote area," says Dr. Warner. "That's where these expert systems may find their most dramatic application."

The barrier to putting Iliad into the doctor's office right now is the effort it takes to get enough patient data into the machine. "That all has to be done manually."



Comdu in the operating room: The program graphs fill rates and volumes so surgeons can properly regulate the artificial heart.

PHOTOGRAPH BY WILLIAM STRODE/BLACK STAR

Beyond the question of the work involved, will doctors resist the computer as an interference in their professional duties? Dr. Warner thinks not. "When you think of the computer's potential as a quality-control device, it will be a tremendous tool for protection against malpractice.

"My gut feeling is that very soon now it's going to reach a point where people are going to demand it. Those kinds of systems are going to be recognized before very long as allowing the physician to do a better job. Once that happens, it's going to be malpractice if you don't do it, because all of a sudden you're no longer sufficiently well equipped to take on the task. If you make a mistake, you're

This is the domain of Stephen C. Jacobsen. In 1967, when Willem Kolff started the artificial-organs program at Utah, Jacobsen was working on his master's degree.

"I'd always liked designing things, so working with the design of medical stuff was really great," says Jacobsen. "Dr. Kwan-Gett and I worked together on both hearts and kidneys."

After he finished his master's degree, Jacobsen worked in the artificial-heart lab until he left Utah to work on a Ph.D. at MIT.

"When I got back here I watched what happened with the artificial heart, but I stayed out of it, because frankly it was just very political. So I worked with artificial arms and arti-

fined by the problem, so early on we might have a project that requires some basic physics and some chemistry, and that's the kind of people that are involved with it, and as it goes on, the flavor changes to a group of people who are more interested in applications. People are magic, and if you manage the environment and not the people, then you get the results that we get."

Two CED projects in particular—the Utah Artificial Arm and the Utah/MIT Dextrous Hand—have attracted a great deal of attention. The Utah Artificial Arm is an electrically powered device for amputees, controlled by the electrical signals generated by muscles in the wearer's

Dr. Warner's Iliad system, on a network of Macintoshes, is an attempt to do nothing less than automate the procedure that lies at the center of the practice of medicine: differential diagnosis.

leaving yourself open to criticism.

"That's the way it is in medicine. You go for a long time with a lot of skeptics about a given technology. Then, almost overnight, it becomes malpractice if you're not doing it."

The University of Utah's Merrill Engineering Building looks like a high school—a high school that's been taken over by its science club. A huge turbine engine dominates the entrance hall. Display cases that anywhere else would be filled with basketball trophies instead hold spidery little cars, all wheels and wire and rubber bands, the winners of forgotten design competitions.

School is out, and the echoing hallways are dimly lit by sunlight filtering through classroom windows. But up on the third floor, in the Center for Engineering Design (CED), chaos reigns. The center's big laboratory is being remodeled, and the contents have temporarily been crammed in a jumble in a much smaller lab room.

cial kidneys."

Jacobsen started the CED in 1973. "We still do medical things, and we still do technical things. There's probably a larger technical component in what we do than there is in the heart. That sounds blasphemous, but the heart's a very difficult problem, and they do a lot of cut-and-try.

"We do robotics, we do medical development, we do interactive robots, we build micro things. We're building micro electrical systems, extremely small things." The lab has done design projects for a variety of corporate and governmental clients, ranging from Walt Disney to the U.S. Navy, for which it designed a teleoperation system—a remotely operated robotic hand.

Jacobsen's description of the lab's operation is casual: "The game is to find things that are fun and then have enough of them so we can keep the people we want to have here busy." But he makes the process of structuring a research program sound chaotic. "We sort of use the muddle method. Who's on the team almost gets de-

shoulder and remnant limb. The arm and its related control technologies are marketed by a technology-transfer company, Iomed, Inc., in Salt Lake City. Iomed also markets a CED-developed electronic device that administers drugs through the skin without injection.

The Utah/MIT Dextrous Hand came about, says Jacobsen, because people kept saying the artificial arm should have a more capable hand. "I thought that was a great idea and started thinking about what we would have to do."

That thinking led him to the conclusion that he needed to understand more about manual dexterity: how a hand applies force to hold an object, and how its tactile senses provide feedback to keep the force appropriate to both the object and the task being performed. And that led to the realization that there was no proper laboratory tool for doing research on dexterity.

Jacobsen and a colleague at MIT, J.M. Hollerbach, launched a project to develop such a tool. The result was

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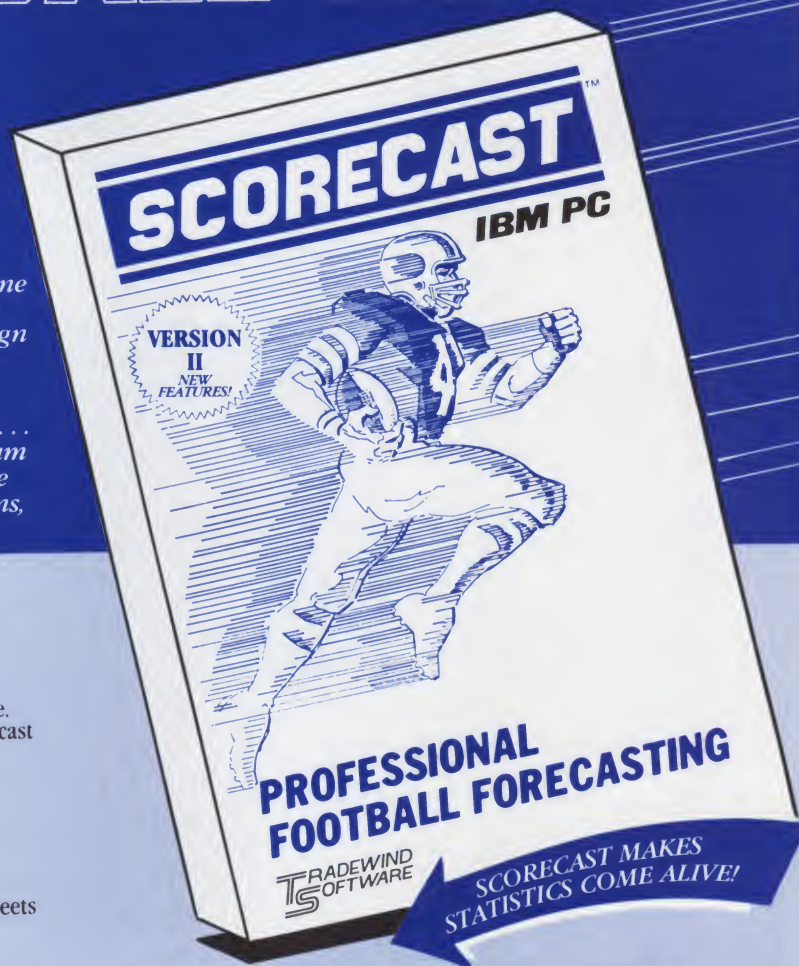
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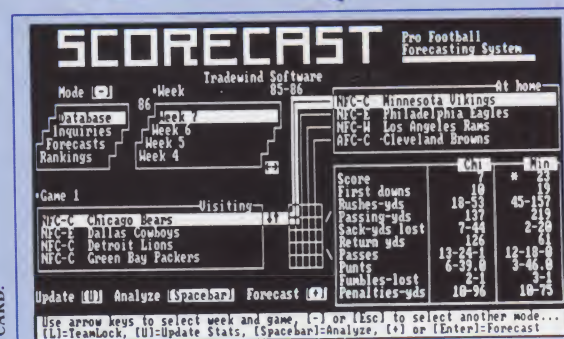
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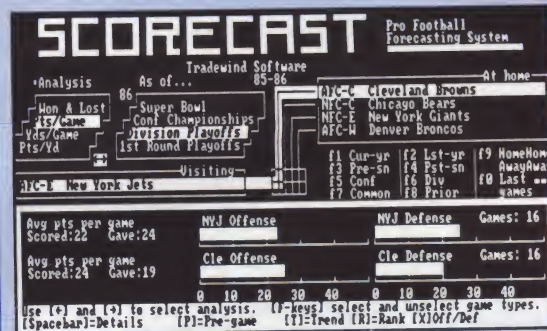
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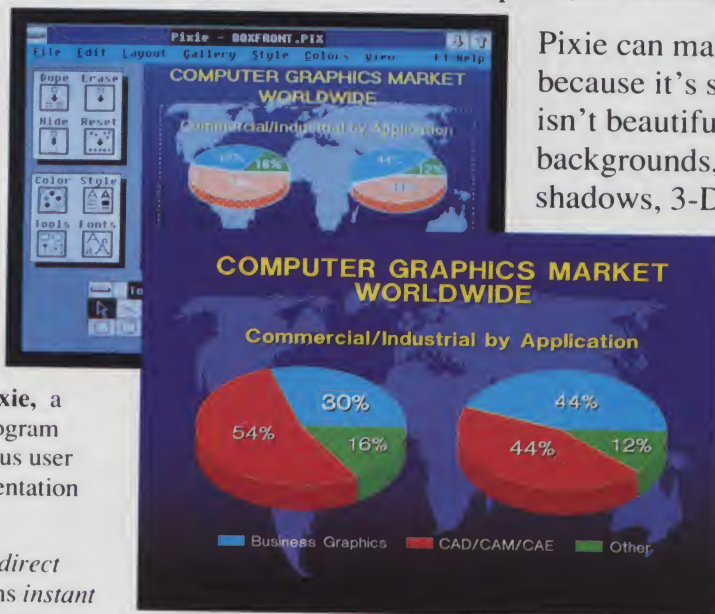
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Compatible with professional systems?	Yes (Mirage)	No	No
Price	\$195	\$495	\$495



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a device with three fully articulated fingers and a thumb, a mechanical hand controlled by several Motorola 68020 processors and designed to work as much like a real hand as possible. Nine hands were built for universities and research institutions, which use them to study sensor technology, computerized control systems, and the design of more specialized robotic tools.

The Center for Engineering Design's computer room—right off the cluttered room that serves as conference center, seminar suite, and reception area—is packed with Apple Macintoshes and Sun workstations for computer-aided design. Some hanging plastic protects a more or less climate-controlled area for a handful of Digital minicomputers.

Jacobsen, however, is more interested in the results of his lab than in its tools. "We do a lot in a lot of areas, but we never talk about it. For example, we probably have the biggest plastics fabricating facility of any laboratory like this in the United States. I go to MIT, Stanford, all these places, and we've got more stuff. The difference is their deal is to study it and write papers about it. We just use the stuff. We know how to use it, we could write papers on it, but that's not what we do. What we pride ourselves on is making things work."

When pressed, however, Jacobsen will tick off some of the available tools: "Well, we've got three MicroVaxes, a Digital 11/750, we've got some Suns, and we've got some other stuff coming, and we've got 20 Macs. There's a stripped-down Sun that's used with Condor, which is the language for controlling the hand. There's another Sun coming that's going to be a development system that has to do with a whole bunch of control functions for the teleoperation system.

"Some of the Vaxes are running systems to support design. We've got VTI software to design integrated circuits. We've got the Case system for the design of printed-circuit boards. And we've got Ansoft's system for electromagnetic field modeling, Matrix_x for doing dynamic systems

modeling. So there are four really substantial software packages that are used for the design of mundane things like PC boards, all the way up to doing exotic things like field modeling.

"We've also got things like VersaCAD for the Macintosh and probably 70 other software packages to do all our word processing and designing graphics. So there's a low level—the design of mechanisms and machinery and administrative stuff—that's all done on the Macintosh, and the Digital systems do those four major software packages, and the Suns are tied up with robotics and so on. Oh, yeah, we've got a five-axis Monarch mill in the basement, and we do some work on transferring databases on machine parts into the language for it. We're also getting a numerically controlled lathe. So I guess we're doing it all."

Not only does the CED use computer systems, it designs them: microprocessor-based control systems for the Phoresor drug-delivery device, for the Utah Artificial Arm, and for the teleoperation devices. But Jacobsen, even with his engineer's love of problems to solve and tools to use, isn't ready to turn the world over to digital computers. And he sees clear limits to the problems that engineering, manufacturing, and materials science can solve.

For example, he thinks such ideas as fully functional artificial hands that attach to amputees' wrists will remain in the realm of science fiction for the foreseeable future. The stumbling block, he says, is complexity. "If you look at a real arm and just look at the parts count, it is enormous.

"As an engineer, if you look at biology you get depressed because you realize that in the media you work with now, like metal and silicon and so on, you can't do those kinds of things. I think the real answer in the world of biology is biology, in silicon it's silicon, and in wrenches it's wrenches.

"The way we're going to have better health care in terms of prosthetic limbs and hearts is by understanding biology and building them that way. Biology can make things like nothing



The Jarvik-7 artificial heart and its controller: The pneumatic-powered device may be succeeded by totally implantable hearts.

PHOTOGRAPH BY WILLIAM STRODE/BLACK STAR

else on earth. If it can build things like arms, the brain, hearts, that's the way to do it. And that is engineering. I mean, if you knew how to run biology, it would be engineering."

Is Jacobsen implying that a totally implantable artificial heart isn't possible?

"Well, a totally implantable heart will beat 90 million times a year. I can take a piece of their best rubber—and it's good for maybe three years? But in your heart the rubber would be down inside, there's stuff being deposited on it, very active chemicals penetrating the surface. It's *Star Wars* down there, right? Maybe they'll do it, but I have doubts. I don't think they can do it with the classical techniques in a way that somebody would

Robert Jarvik is setting up shop, starting all over again.

His office is dominated by what seems like half an acre of black glass-and-leather desk. A credenza to one side is littered with his accomplishments, and as he talks about the abstractions of development and innovation he turns often to the physical objects for support: a tiny electric motor, a valve machined from solid titanium, an artificial heart with its right and left sides held together by Velcro.

Across from the desk, framed magazine covers sketch the history of the media's love affair with the Jarvik-7 heart—an array of brightly colored photographs of the designer, the surgeon, the patients, the heart itself.

and he's disappointed by the loss of a platform for developing his ideas. "We did a lot of work to develop the research capability [at Symbion]. I had the idea for the intraventricular heart when I was fired, but if I had the company now I could do that very readily. To my knowledge they're not working on a permanent implant device there."

The intraventricular artificial heart is an idea for a miniature heart that would be inserted into the natural heart. "So the device is very small. The favored design now is a rotary blood pump that would be about the size of an egg. It would have one moving part, and it would be surrounded by the natural heart muscle, so that would protect against infection. The

The key design problem for his new heart, the three-dimensional design of the blood-pump blades, is a challenge Dr. Jarvik plans to tackle with a 386-based PC and a regular CAD system.

want to have it, other than somebody with a gun to their head.

"If you sit back and ask is this worth the society's money, and in fact is it worth old Frank's time—they're going to stick this thing in his body and he's going to feel like hell—somebody logical would answer it's a ways off. I just think that what will happen if we wait a little bit and understand biology is that we'll *grow* another one. Old Frank starts getting sick, so we'll grow him a heart."

So the costs, financial and human, just don't justify the benefits of the artificial heart?

"To put it in simpler terms, it didn't work. They got their nickel and put it into the slot—you pay your money and you take your chances—and none of them worked."

The new headquarters of Jarvik Research is a long way from the old St. Mark's Hospital. Halfway up a high-rise hard by Lincoln Center in Manhattan's West 60s,

Dr. Jarvik's own history has been stormy. He joined the staff of the Artificial Heart Research Laboratory in 1971 with a master's degree in biomechanical engineering and a job description as a designer. He started medical school the next year and returned to the laboratory in 1976.

When Willem Kolff founded Kolff Medical to manufacture and sell the artificial heart, Dr. Jarvik became an executive in the company, but the two quarreled bitterly over the timing of the public stock offering. Eventually Dr. Kolff bowed out, leaving Dr. Jarvik in control of the renamed Symbion. After the public offering in 1983, Dr. Jarvik became chairman of the board.

In early 1987, Dr. Jarvik vigorously opposed a takeover offer from Symbion's venture capitalists, the Warburg, Pincus Capital Company. He lost. In April of that year, he was replaced as chairman of the board.

He left Salt Lake City and moved to New York, where Jarvik Research is pretty much a one-man shop. Dr. Jarvik remains committed to research,

control would be fairly straightforward, with a feedback system adjusted to the natural tendency of the heart through the pacemaker function."

The pump would replace the natural valves of the heart, Dr. Jarvik says. "If you needed total heart support, you'd put one of these devices in the cavity of the left and another one in the cavity of the right ventricle."

The key design problem, he says, is the three-dimensional design of the blood-pump blades. Bladed rotary pumps in the past have caused damage to red blood cells. The blading, he says, "is an excellent problem for a computer. I'm going to do that with a PC with a regular CAD system for better 3-D design technology." He is actively shopping for his CAD system and has narrowed the field to two 80386-based systems. "I'll let you know what I decide."

Personal computers, says Dr. Jarvik, have influenced popular attitudes about what can be accomplished. "I can remember doing my biomechanics master's in 1970. We had the old punch cards to do statistics with, and

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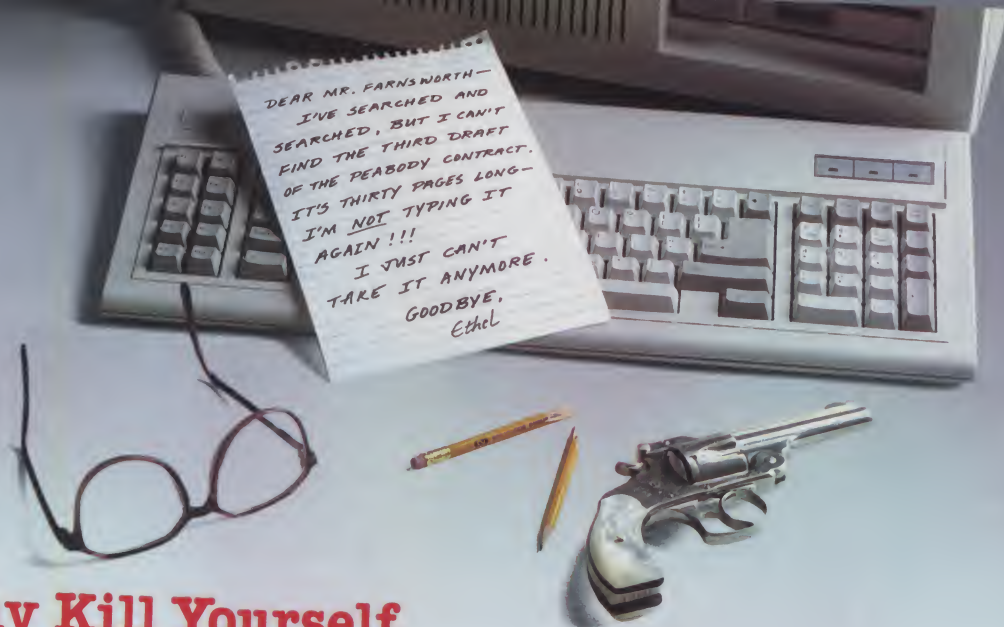
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it was just a bear. It took hours and hours and hours to do stuff that now is just nothing. It was so frustrating to get somebody to enter the data onto the cards so that we could run the stats through the machine. It was nuts. I guess this should make me feel old. But I also think the attitudes about what's doable have totally changed, and I know that when I think of the new generation of artificial-heart systems, I'm highly confident that we can do things that a decade ago we would not have tried because it would not have seemed that the real detail was practical."

Dr. Jarvik recalls a picture he found of a group of people in a laboratory. "There were about half a dozen people there in the picture. It was taken like 1969 or something, and they're all over the place now, and practically every one of them is a major success in his area. It makes you think: Gee, it's not because that program was that great. It's not that it was this phenomenal collection of people who were all that good. It's because the people who were there when the seed of a new thing started—when it did well, they all did well. I think that certainly exists in Silicon Valley, and I think it exists to some extent around people involved in artificial organs early on at Utah."

This is an interesting statement. It might be a casual put-down of the people left behind in Salt Lake City—which would be in character for a man with a reputation for ambitious self-promotion. But coming from a man who sits facing a wall covered with testimonials to his celebrity, it sounds more like self-judgment, and a rather harsh self-judgment at that.

He may be wondering whether lightning can strike twice. He has announced his intention to do something difficult: develop a permanently implantable artificial heart. Can it be done?

"I think that there hasn't been time for but a small fraction of the applications to be worked through," he says.

Dr. Robert Jarvik put his name on the artificial heart, and now is starting over to design an intraventricular model.



"So I think there's this backlog of doable things with the existing micro-computer technology, and it's getting done at a faster and faster pace by all kinds of different groups."

Homer Warner says it more directly: "Every day, something new comes out that gets you convinced there's no end to what we're going to do with these little machines." ■

PHOTOGRAPH BY GEORGE LANGE

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Power to the People

**Intel's new 386SX
processor is the life
spring of a powerful
new PC—good tidings
for cost-conscious
consumers who yearn
for the power of a 386.**

By JOHN DICKINSON

You shouldn't settle for anything less than a 386. Since their introduction in 1986, powerful 386-based PCs have been the high-priced darlings of power users.

If you don't have a 386 machine on your desk, it's probably because your company hasn't been willing to put 386-sized dollars into your hardware budget. Those dollars have been reserved mostly for engineers who need to use computer-aided design software, graphic designers who need to use multicolored bit maps, and financial whiz kids who need to make program trades in split-second time.

PCs such as those in the Compaq Deskpro 386 series, the IBM PS/2 Model 80 and Model 70, the Dell System 300, and many others are still out of reach for most of us. You've probably had to settle for a 286-based AT or compatible, or maybe even an 8088-based XT.

PHOTOGRAPH BY EDWARD ADDEO/LETTERING BY ANN POMEROY

That's about to change. (Sound FX: trumpets.)

Last June, Intel, the company that designed the microprocessors used in IBM-compatible PCs, introduced the 80386SX, a low-cost version of the 80386 processor that manufacturers can use to build cheaper 386 machines.

Compaq was first in line to take advantage of the new processor. The company's first of the new breed

ly need a 386 if you want the kind of hardware performance that future applications programs and operating systems will use.

But 386 processing power is not *de rigueur*. It may make no difference if you're a DOS user who usually runs only one program, like a word processor or a spreadsheet, or who runs more than one program but uses them one at a time—or if DOS's standard 640K,



The 386SX is as fully functional as a 386, except when it comes to I/O speed. Like the 286, it moves data in 16-bit (as opposed to 32-bit) chunks.

of PCs (drumroll, please) is the Deskpro 386S. It has a small footprint and what amounts to a small base price: \$3,799 (30 percent less than an equivalently equipped Deskpro 386, Compaq's lowest-priced standard 386-based PC, and 25 percent more than the company's highest-priced 286-based PC).

More and more manufacturers will soon introduce machines built around the new processor. Retail discounting and pricing pressures should lower prices even more. In no time at all, 386SX-based PC prices should look more like AT clone prices.

This is all terrific news for those of us who have yearned for 386 power but until now couldn't pay the price. (Sound FX: cheers and shouts.)

Who Should Have a 386?

You're a candidate for 386 power if you want to have several programs available at the touch of a key or mouse button, and you want those programs to be able to exceed DOS's memory and programming capabilities without resorting to solutions like the LIM (Lotus-Intel-Microsoft) specifications. You definite-

perhaps with the addition of a LIM memory expansion board, meets your memory requirements.

The Critical Difference in a 386SX

The most important technical feature of the 80386SX is that it's a fully functional 80386 processor capable of running at 16MHz. It can do anything that any other 386 processor can do.

But here's the 386SX difference: while it manipulates data in 32-bit chunks (as all 386 processors do), it moves data and instructions into and out of itself in 16-bit, rather than 32-bit, chunks.

That single design change allows PC makers to produce high-performance 386SX-based PCs that are simpler (and therefore cheaper) to build than standard 386-based PCs. And it enables PC add-on manufacturers to adapt the processor to 80286-based PCs, such as ATs and compatibles.

Another source of reduced cost: designers can use any 16-bit hardware option—whether of PS/2 or standard PC design—in conjunction with a 386SX-based machine. They can use standard interface cards, such as disk drive and video controllers, without modifying them. And options cards like modems, fax boards, hard disk cards, and CD-ROM adapters also will work in these machines.

John Dickinson, a former editor of Computers in Banking, is director of PC Labs, Ziff-Davis's hardware and software evaluation laboratory.

ILLUSTRATION BY BARRY BLITT

The 386SX processor can directly address up to 16MB of memory. Since plenty of cards already on the market will work in these PCs (including industry-standard 16-bit memory cards like those AST, Intel, and Quadram make for the AT), building a system with that much memory costs relatively little.

Yet memory is the one area where it would be preferable for the new PCs to use cards that have been especially designed for them. Normal option cards—including most memory cards—are designed to run at the 8MHz speed of the I/O (input/output) channel. But the 16MHz speed of the 386SX processor allows it to access memory twice as fast as that, improving performance considerably.

Compaq's design for the Deskpro 386S is especially clever in this regard because it gives users two price/performance options for memory expansion. The machine supports standard memory cards through its industry-standard 8MHz I/O channel, as well as Compaq's own, high-speed proprietary card through a special 16MHz memory channel.

Adopt a 386SX

The 386SX is also good news for budget-conscious AT owners: you can use the 386SX as the basis for building inexpensive adapters to upgrade your current 286-based AT, AT-compatible, or PS/2 to a 386-powered machine. Option cards based on standard 80386 chips, such as Intel's Inboard and Quadram's Quad386, are on the market now; they are built with on-board 32-bit memory, occupy a 16-bit expansion slot, and cost about \$1,000. But manufacturers will likely soon offer adapters that use the 80386SX on small cards that plug into the 80286 processor socket, leaving you with the same number of expansion slots.

What makes this possible is that the 16-bit I/O design and 24-bit addressing scheme of the 80386SX is similar to the I/O design of the 80286 that powers ATs and compatibles. So designers can adapt the processor to use the system board, memory, and peripherals already installed in 80286-based machines, without using a lot of circuitry that requires a large expansion-sized card.

A hybrid AT/386SX machine could run the same software as any 386-based PC but at a slower speed, since the 80386SX on the adapter card can't run any faster than the clock speed of the host PC. If you plugged the adapter into an 8MHz AT, for example, the 80386SX processor would run at 8MHz.

Any Takers?

Price alone will no doubt prompt quick replacement of today's 286-based PCs with new 386SX-based

PCs—the 386SXs will probably become the next generation of midrange PCs. At the same time, users of 286-based PCs can upgrade them to 386SX PCs.

Compaq makes no bones about the fact that its Deskpro 386S is targeted to challenge the popular, 286-based IBM PS/2 Model 50 and Model 50Z, and every AT clone on the market—or at least every one that Compaq doesn't make.

Following Compaq's lead, other vendors, including NEC, Hewlett-Packard, and NCR, claim to be working on 386SX-based PCs. NCR even had a 386SX prototype system running in a back room at Spring Comdex. Expect announcements of more 386SX-based PCs soon, with shipments starting by early next year.

IBM has been silent, true to its practice of keeping mum on unannounced products. But Entry Systems Division president Bill Lowe has committed the company to a PS/2 line powered by 80386 processors at all price points, including the lowest, within the next two years. That strategy just about spells 80386SX.

Option makers are also playing it close to the chest, saying little about building 386SX replacement adapters for 286-based machines. But Intel says its engineers have built prototypes of low-cost AT upgrade adapter cards. So rest assured: the company will probably be selling them soon. As for the rest of the industry, the introduction of upgrade kits using the 386SX will depend almost entirely on the availability of the new processor.

386 Software Scene

All software designed to use the 386's nifty hardware features will work on the 386SX machine. Some programs already take advantage of the processor's most exciting features. The list includes multitasking operating environments for DOS programs, standalone DOS applications specially configured to use the 386's power, and full-blown multitasking and multiuser operating systems.

You don't need a special operating environment to take advantage of a 386SX-based PC if you run programs that extend DOS beyond its 640K limit and use its more powerful 32-bit instruction set. But you will need to use such an environment if you need multitasking capability.

Microsoft is the prime mover in multitasking operating environments for all PCs, including 386s. The



Intel has packed the punch of the 386 (top) into the diminutive 80386SX.

company's Windows/386 Presentation Manager, a special version of Windows, takes advantage of the virtual 8086 feature of the 80386, which gives each program you load its own 640K PC and DOS. You get a standard Windows graphical user interface and enhanced graphics support for certain applications, including Lotus 1-2-3 and Microsoft Word, so that they can work in layered windows. Windows/386 Presentation Manager can also supply expanded memory support compatible with LIM 4.0.

While Microsoft has pushed the market toward graphics-based operating environments, Quarterdeck has pushed it toward character-based multitasking and windowing environments. Like Windows/386, the company's Desqview 2.0 uses the virtual 8086 mode of the 80386 to provide a multitasking environment for standard DOS applications. If you add in

Quarterdeck's QEMM-386, your applications will have LIM 4.0-compatible expanded memory support as well.

386 and DOS Programs

Most commercial applications for the 386 are special versions of familiar DOS programs. They include Borland/Ansa's Paradox 386, Oracle's Professional Oracle, Fox Software's FoxBase+/386, and Symantec's Q&A Version 2.0 database management systems. A special version of Micro Control Systems' Enhanced CADkey 3.0 computer-aided design system is also available for 386 PCs. And 386 versions of memory-hungry applications, such as spreadsheets, should turn up soon.

Programmers can use 386 DOS-Expansion from Phar Lap Software to extend applications beyond the

Compaq Takes the SX Lead with Deskpro 386S

Intel had just announced its new processor when Compaq stepped up with the first 386SX-based PC, the Deskpro 386S. As they have done so frequently in the past, the innovative Texans at Compaq showed their competitors the right way—or at least a good way—to build the new midrange computers.

Small size was an important design objective for the Deskpro 386S. Compaq's market research revealed that customers are eager to retrieve desktop real estate lost to earlier generations of PCs; many users want to place their PCs on L-shaped returns and credenzas where full-sized models won't fit.

Deskpro's new all-steel cabinet is slightly smaller than that of an IBM PS/2 Model 50 (it's wider but shallower), a size that requires a higher level of system integration than usual. Compaq came up with a new and clever cabinet design.

The expansion needs of midrange PC users were also a driving force behind much of the integration embedded in the Deskpro 386S. Thanks to Compaq's designers, you can buy a fully configured system with VGA (video graphics adapter) display, floppy and hard disks, tape drive, and up to 13MB of RAM installed without using even one of

the four available AT-compatible expansion slots.

Electronic integration turns up almost everywhere inside the Deskpro 386S. Hard disks include integrated ESDI (enhanced small device interface) controllers. The system board includes an integrated VGA adapter mounted on a daughterboard, eliminating two expansion cards found in a normal Deskpro and most AT compatibles. The system board also includes parallel and serial ports for printers and modems, as well as a PS/2-compatible mouse port.

The system board itself is also tiny by normal Deskpro standards. It depends on four Compaq-designed ASICs (application-specific integrated circuits) to operate its circuitry. All components—including the 80386SX—are surface mounted for additional compactness. The only exception is the socket for the optional 80387SX floating-point math coprocessor.

The mechanical design of the smart-looking new cabinet provides front-access slots for one half-height and two third-height disk or tape drives; the access slot for the primary hard disk is tucked away behind them. The 140-watt power supply comes in a long, narrow format that slides into the right-hand

side of the cabinet, much like power supplies in IBM PS/2 PCs. Even the otherwise industry-standard 101-key keyboard is smaller; Compaq designers decided to slice about 2 inches off the depth of the full-sized model.

Installing option cards, disk drives, or even changing the battery that powers configuration memory can be difficult in small-footprint PCs, but not in the new Deskpro. As with all Compaqs, you'll need a Torx wrench to loosen everything except the outer shell, which is held on with coin-driven screws. Every other removable part and option is accessible and easy to work on.

Competitive 386SX power doesn't have to be stuffed into a small package like the new Deskpro, and other PC manufacturers may choose not to follow suit. But they do this at their own peril, especially in light of IBM's recently announced Model 70s, which deliver full-scale 386 power in the same tiny cabinet as a Model 50.

The competition probably will follow Compaq in delivering multiple I/O options, including large-scale hard disks, 5¼-inch and 3½-inch floppy disk drives, and built-in tape backup units. The Deskpro 386S base Model 1 comes with 1MB of RAM installed on the

limits of DOS. Compilers to support 386 DOS-Expansion are available from MetaWare, Green Hills Software, and Phar Lap.

If you choose this route, you'll be in good company. Borland used 386 DOS-Expansion to give Paradox its 386 edge, as did Interleaf when it converted its Unix-based desktop publishing system to run on DOS-based PCs.

Operating Systems

Microsoft and IBM would like you to think of OS/2 first whenever you think of full-scale multitasking operating systems for your PC. The two companies jointly developed OS/2 to run on 80286- and 80386-based PCs. OS/2 must be tailored to the PC it runs on, and IBM was first to ship versions of OS/2 for its PS/2 and AT computers late last year. Compaq and

Dell recently followed suit.

OS/2 is currently a character-based system, designed to work with a graphical interface much like Windows or the Apple Macintosh interface. OS/2's interface, called Presentation Manager, will be released soon.

OS/2 lets you run OS/2 programs concurrently in the foreground—where you interact with them using the screen, keyboard, and mouse—and in the background, where no interaction is possible. A background program might be inactive, waiting for you to call it to the foreground. For example, you might be writing a report when a colleague telephones you with a request that you can fulfill only by looking at a spreadsheet. A background application can also be active, performing a time-consuming task such as downloading your electronic mail or selected files

system board and a 1.2MB, 5¼-inch floppy disk drive as standard equipment. You can add a 110MB hard disk, or get a Model 20 or Model 40, which come with 20MB and 40MB hard disks. You can add one additional hard disk of any size, which yields a storage capacity of 220MB. You can also add a 3½-inch disk drive and a cartridge tape unit.

Installing a proprietary Compaq memory card that runs at the processor's full 16MHz speed adds additional RAM in 1MB or 4MB increments. Or you can install standard memory cards in any of the four AT-compatible expansion slots. Plus, you can use both types of memory simultaneously. Any memory you install using standard expansion cards, however, will run only at the 8MHz I/O bus speed.

System software options for the Deskpro 386S include MS-DOS version 3.31 or Compaq's OS/2 version 1.0, which includes the DOS Compatibility Box. Compaq also includes a disk cache program for DOS operation of the hard disk, Microsoft Basic, and backup software if your system has a tape drive.

The Deskpro 386S performs well; we ran the system with DOS 3.31 and Windows/386 for multitasking. It's slower than a full-scale 16MHz

386, but it pulls away smartly from most of the 286s around. The 386S does almost everything in the benchmark suite about twice as fast as an 8MHz IBM AT. It ran our benchmark tests about 20 to 60 percent faster than the new 10MHz IBM Model 50Z, which is quicker than older Model 50s because of a zero wait-state memory design. And it's only about 10 to 15 percent slower than a standard 16MHz Deskpro 386.

The 40MB hard disk's 29-millisecond access time is equal to that of hard disks installed in many standard 386-based PCs. It's especially quick at creating, reading, and writing DOS files if you read far enough into the instruction manual to install the included caching software (a good idea with any system).

The internal VGA adapter has the same circuitry used in Compaq's VGA adapter: a 16-bit data path with BIOS optimized to take advantage of it. As a result, it's faster than most VGA adapters on the market, although Hewlett-Packard and others are now shipping competitive 16-bit adapters.

One thorn in Compaq's—and Intel's—side these days is Dell Computer's System 220 and the speedy 20MHz 80286 that powers it. The Harris Corporation manufactures

the new processor under license from Intel, and it's being shown in several low-cost 286 PCs such as the one from Dell. Make no mistake about it, this new 286 is *fast*, beating the Deskpro 386S hands down in most of our benchmark tests. The System 220 will even give slower 20MHz 386-based PCs, such as the IBM PS/2 Model 80 and the HP RS/20, a good run for their money. The trouble with fast 286s, of course, is that they can't run software written for a 386S.

Two major sources of competitive pressure will have an impact on the Deskpro 386S and its 80386SX processor. Low-cost, standard 80386-based PCs—including models that run at 20MHz—are becoming more common; many are priced right in line with the Deskpro 386S. Faster, less-expensive 80286-based PCs like the Dell System 220 will also give the 386S a hard time and put pressure on Intel to come up with a 20MHz version of the 80386SX processor. Even the more expensive desktop 386-based IBM Model 70s may draw away some potential buyers.

But make no mistake about it: for Compaq quality and 386 power in a small footprint at a reasonable price, you can't beat the Deskpro 386S—at least for now.

—JD



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from a network, while you work on something else in the foreground.

OS/2 is also designed to use the so-called protected mode of both 80286 and 80386 processors, which releases programs from DOS-like restrictions such as the 640K memory limit.

The word is out that IBM and Microsoft are working on a future version of OS/2 that will run only on 80386 processors.

Another major multitasking operating system available for 80386-based PCs is VM/386 (VM

stands for Virtual Machine), which runs multiple copies of standard DOS. The product employs the 80386's virtual 8086 mode to emulate a standard PC processor running DOS. Like OS/2, it enables you to inter-

The new solution for desktop computing will almost surely require a 386 microprocessor.

act with a program in the foreground while other programs run in the background.

The biggest advantage of VM/386 over OS/2 is that it lets standard DOS applications—which are far greater in number than OS/2 applications—run concurrently. A disadvantage is that those applications suffer from the usual DOS limitations. DOS program developers like VM/386 because they can reboot each virtual 8086 PC—when the program under development crashes DOS—without rebooting the entire computer, a feature sorely lacking in OS/2.

PC-MOS/386 is a multiuser time-sharing system similar to systems that run on minicomputers and mainframes. The system distributes DOS processing power to users via standard (a.k.a. dumb) terminals. The system supports PC-compatible applications as well as applications designed to use the full power of the 80386 processor.

Other multiuser systems include several versions of AT&T's popular Unix operating system for the 80386. Microport's System V/386 Runtime, Interactive Systems' 386/ix, and Bell Technologies' Unix System V/386 are all compatible with Unix Version 3. SCO Xenix 386 System V from the Santa Cruz Operation is compatible with Unix Version 5.

Future + Computing = 386

Whether the new solution for desktop computing is OS/2, Windows/386, Unix, or something as yet unannounced, it will almost surely require a 386 processor to maximize its value. And even if you don't need multitasking operating systems or large-scale programs now, you may need them sooner than you think. The limits of DOS's capabilities have been reached, and its demise is inevitable. (Sound FX: a distant dirge.) But thanks to Intel's 80386SX processor, you no longer have to settle for less than a 386. (Sound FX: applause.) ■

Inside 386 Technology

▶ The 80386 is advanced technology. Processing power and speed earn it that status. The 80386's processing power lets programmers write more sophisticated programs. Its speed lets users run those programs faster.

As an added benefit, the 80386 is compatible with the 8086, 8088, and 80286 processors used in IBM PCs, PS/2s, and compatibles. Programs written for those processors run faster under an 80386.

More Power

The 386's speed and power spring from several sources in the architecture and technology of the processor. The most important source of processing power is the 80386's ability to run multiple applications in protected memory areas. That means the chip's hardware contains logic that prohibits the possibility of one program corrupting memory occupied by another program, the data for another program, or even its own data.

Processors like the 8086 that are designed to operate only one program at a time are said to run in real mode, while multitasking processors operate in protected mode. The protected mode feature of the 80386 allows you to use multitasking operating systems like OS/2 and multi-user operating systems like Unix easily and safely.

The 80286 includes a feature similar to protected mode; it's less sophisticated in design, so writing operating systems for it is more difficult. Like the 80386, the 80286 can operate in real or protected modes. But the 80386 switches easily between modes, while the 80286 cannot switch from protected mode into real mode.

Another advancement in 80386 multitasking is emulation of multiple 8086 processors in its protected mode. Intel engineers designed this

feature to make it easy to operate popular DOS programs in a multitasking environment.

Two other important sources of power stem from the processor's ability to manipulate data in 32-bit chunks called double words. The 8086 and 80286 processors can work with up to 16-bit (single) words only. The 32-bit capability of the 386 permits arithmetic on large-scale integer numbers using direct instructions rather than the complex algorithms that 16-bit processors demand.

The 80386 also can process memory addresses in 32-bit chunks, so it has access to much larger amounts of memory than the 8086 and 80286 processors. The earlier Intel processors were limited to 16-bit words; a segmentation scheme was designed to allow the 8086 to use 20-bit addresses to access up to 1MB of memory and the 80286 to use 24-bit addresses to access up to 16MB of memory.

The 80386's 32-bit address allows it to access up to 4GB (that's gigabytes, or billion bytes) of memory. Most 80386 implementations to date limit system memory to 16MB, although some vendors such as Hewlett-Packard have provided for additional memory in their 386-based PCs.

More Speed

The speeds available for 80386 processors are wider-ranging and faster than those offered by any other Intel processor. The slowest model runs at a 12.5MHz clock speed; the fastest runs at 25MHz. Faster versions of the processor are expected in the future, although higher clock speeds might be reserved for Intel's 80486 processor (expected in 1989).

Until recently, 80286 processors had a maximum clock speed of 12MHz, which made 386s the fast-

est game in town. The Harris Corporation now ships 16MHz and 20MHz versions of the chip, making it possible to produce very fast 286-based PCs such as the Dell System 220.

Yet other sources of speed will keep most 386-based PCs ahead of 286s running at equal clock speeds. New hardware designs and better-integrated circuit technology make for faster instruction coding—hardware programs that do the step-by-step work of a processor instruction. Like every new generation of processors that came before it, the 80386 delivers the same instructions more efficiently than previous models. As a result, it takes fewer clock cycles to execute the same instruction on a 80386 than it does on an 80286, which takes fewer cycles than an 8086.

In addition, the 80386 employs an instruction look-ahead technique previously found only in minicomputer and mainframe processors. The 386 has an on-board instruction memory cache where it stores what it believes to be the next several instructions to be executed. Those instructions are fetched into the cache while an earlier instruction is being executed; they are, in turn, executed while more instructions are being fetched.

As with all caching algorithms, the 386 tends to be wrong on occasion, but more often than not it has the next instruction on board, decoded and ready to be executed. That ability is a major source of its improved performance.

Another major source of speed is the 80386's demultiplexed address and data buses. Previous Intel processors used the same pins for data movement and address movement. Because the same pins had to be used for each type of data, the address had to be placed on the bus first to notify memory of a coming

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data movement. Then the data could be placed on the bus. The 80386 uses separate pins for the address and the data, so both can be placed on the bus simultaneously. This reduces the time needed for manipulating data stored in system memory by nearly half.

Hidden Cost

The increased speed of the 386 causes problems for system designers. Slower personal computer systems use the same I/O bus for memory and peripherals. The industry standard I/O bus speed of 8MHz, however, is not fast enough for memory access made by a 16MHz processor. In addition, faster processors require faster, more expensive memory chips if they are to run at the same speed as the processor.

Several techniques have emerged to solve the problem. All require the peripheral bus to run at one speed and the memory bus to run at another.

The fastest memory chips available are static RAM chips. They are expensive and large, but some PC makers have used them to populate the entire memory area of their 386-based PCs. Other techniques require sophisticated swapping of discrete areas of dynamic RAM, which is less expensive and smaller in size than static RAM.

A third technique, called memory caching, combines a small amount of fast static RAM with a base memory made up of dynamic RAM chips. The static RAM cache holds the data or instructions that a special processor (called a cache controller) thinks the program running in the 386 processor will call on next.

Each memory technique requires installation of more electronic parts and/or more expensive electronic parts, adding to the cost of the sys-

tem. A 386-based PC can be built without these additions, but it wouldn't be able to take advantage of the superior processing speed available.

The 386SX Difference

The data and address size of the 80386SX processor are the same internally as those of any 80386. So is the processor technology, such as the instruction look-ahead feature. And so is the clock speed, at least up to the current 386SX rating of 16MHz.

Data, however, move into and out of the 386SX in 16-bit words, rather than in 32-bit double words. Whenever the processor makes a 32-bit input or output request, it has to divide the processor into 16-bit pieces, which it then moves in sequence. In addition, the width of the 386SX's external address is 24 bits rather than the 32 bits of a standard 80386.

The practical implications of these two design changes aren't as serious as you might think. Since most 80386-based PCs are limited to 16MB, most operating systems and programs written for them have a current limit of 16MB.

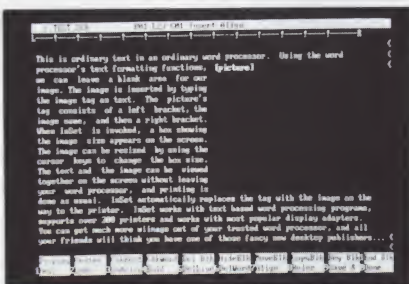
Although programs written for DOS or OS/2 access data only in 16-bit words, the processor fetches the program instructions in 32-bit chunks which come in on the same I/O path, and they will move a bit more slowly in the 386SX than in a standard 386. Programs that use the 32-bit capabilities of the 80386 processor will also run somewhat slower.

The demultiplexed data and address bus is the most serious difference between the wiring of an 80286 and that of an 80386SX. To make 386SX adapters for 286 sockets, builders must remultiplex the data and address information to simulate the operation of an 80286. —JD

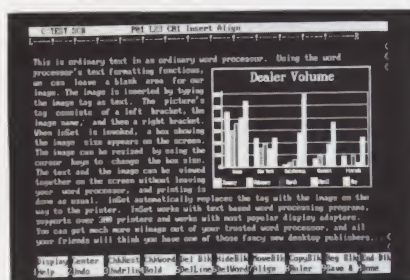
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Computers were used to design both the U.S. team's hard-sail catamaran (left) and New Zealand's 133-foot monohull (right).



SAILWARS

**The America's Cup
has become the
ultimate computer
game.**

By MICHAEL LEVITT



Computers not only helped design the *New Zealand's* hull and sail (above), they also support tactical maneuvering. The crew's on-board equipment (below) includes a Hewlett-Packard HP 9000 Model 330, fed data from a Model 220. It processes three types of information: performance data, sail analysis, and structural analysis. A crew member monitors the data throughout a race.



New Zealand: the Kiwis' challenger



Its exotic hull is rigged with more than half an acre of sailcloth.

Sometime soon, racing sailboats representing the United States and New Zealand will meet off the coast of San Diego for the twenty-seventh running of the America's Cup.

The yacht from New Zealand will be a huge monohull, 133 feet long. The other, from the United States, will be about half that size, but it will be a catamaran, with two hulls instead of one, and perhaps a solid-wing sail rather than the familiar soft kind.

At first glance, the only things these sailboats have in common are that they float on the water, are driven by the wind, and are built to win the America's Cup. Yet both embody advances in sailboat technology that have developed from a powerful mix of two forces: brilliant design and big-time computer power. In post-1983 America's Cup competition, it seems, you can't have one without the other.

Sailing in the America's Cup race changed from an art to a science—a computer science—in 1983. That year the revolutionary *Australia II*, a child of the computer, broke the longest winning streak in sports and ended the United States' 132-year title to the coveted silver trophy. *Liberty*, the losing American

PHOTOGRAPHS BY DAN NERNEY

boat, was of an intuitive design, a close cousin of the type of 12-Meter yacht American designers had been drawing since 1974. *Liberty* wasn't tested before it was sailed. It was merely the best guess of talented designer Johan Valentijn.

For the 1983 challenge, the Australians took a different path. Rather than trying to outguess the Americans, they decided to break new ground. They enlisted Australian naval architect Ben Lexcen to go to the Netherlands Ship Model Basin, a model-testing facility in Wageningen, Holland, with a blank sheet of paper. Lexcen's trip spoke volumes about how serious the Australians were that year.

But towing a model around a test tank, measuring such aspects as its resistance through the water and whether it makes a smooth or bumpy passage, is slow and expensive. And these weren't the only problems with the test tank.

Because of scaling difficulties (of extrapolating from an 8-foot model in a tank, say, to a 65-foot yacht on the ocean), the test tank has approved some abysmal boats—mutants that were found to violate laws of motion and nature.

The most notable test tank failure was the 12-Meter *Mariner*, which raced in 1974. Its poor showing practically killed off tank testing and scientific yacht design in this country. For a simple answer to why the United States lost the America's Cup a decade later, look no further than the antitechnology backlash inspired by the slow, red *Mariner*.

Meanwhile, in Holland with his blank sheet of paper, Lexcen (who died this year) learned about another way to test yacht design: on a computer. Since 1969 the Dutch had been using a prized computer program, called a velocity prediction program (VPP), in their national aerospace laboratory to evaluate the efficiency of lifting surfaces. Joop Slooff, head of the theoretical aerodynamics department there and a sailor himself, believed the VPP could be modified to test the efficiency of the lifting surfaces on sailboats—keels, in particular.

A keel might be thought of as a sailboat's underwater wing. Weighted with lead, it serves two purposes: it changes the sideward force of the sails into a forward force, and it balances the heeling forces of the sail plan. In a fateful moment, Lexcen, who was not wholly comfortable with computers, decided nevertheless to avail himself of this Dutch computer wizardry.

He tested two ideas novel to yacht design: a keel that was wider at the bottom than at the top, and a keel with wings on it. There is turbulence where the keel meets a boat's hull—as there is turbulence where the wings meet an airplane's fuselage—so decreasing the keel's area at the top, it was reasoned,

should reduce the disturbed flow of water at this joint. Similarly, the turbulence at the end of a wing (or at the bottom of the keel) can be reduced by a "fence" or winglets—an idea borrowed from NASA.

Lexcen tested subtler features as well. By angling the wings down, he gave the model—and later the boat—more draft, or depth, when it heeled, which helped increase keel efficiency. He also ballasted the wings with lead, making for a stiffer yacht that can

Each represents a leap in technology that required two things: brilliant design and big-time computer power.

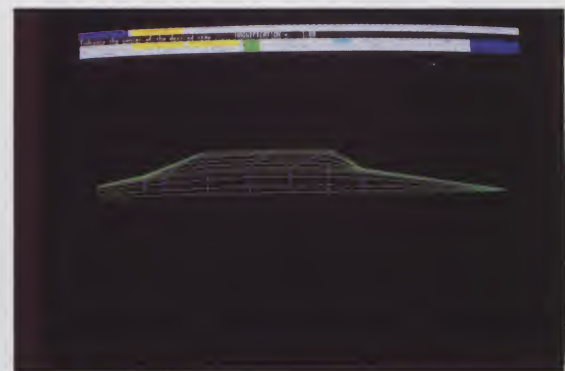
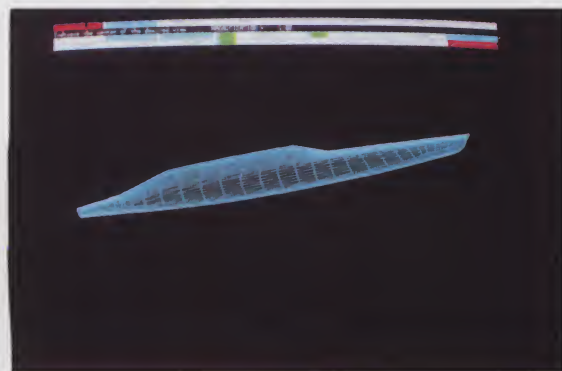
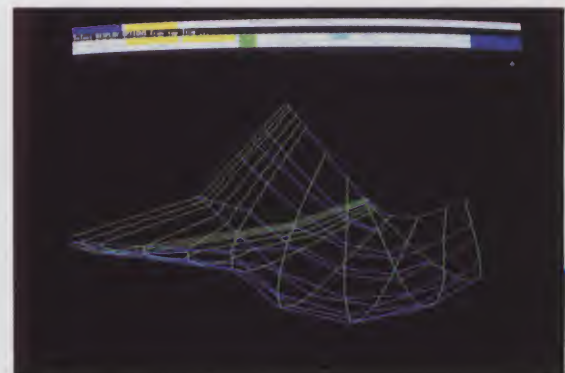
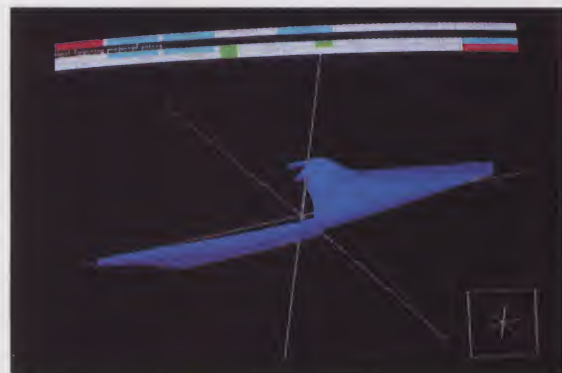
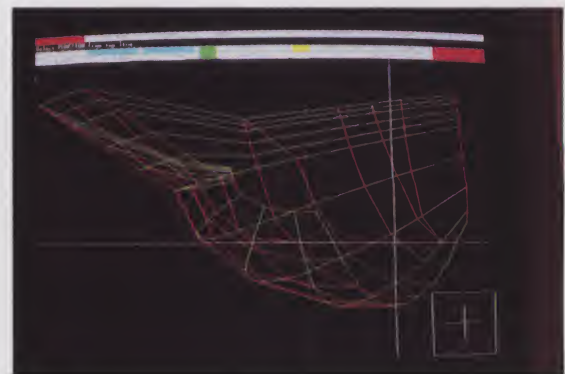
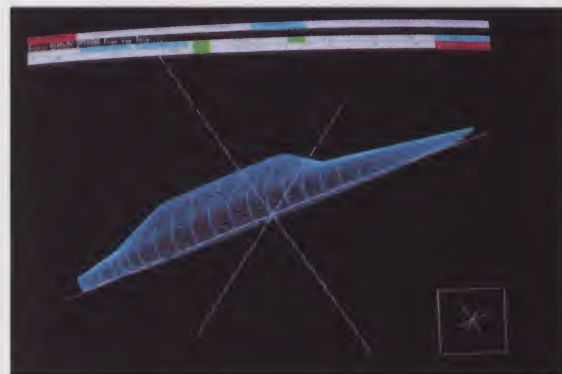
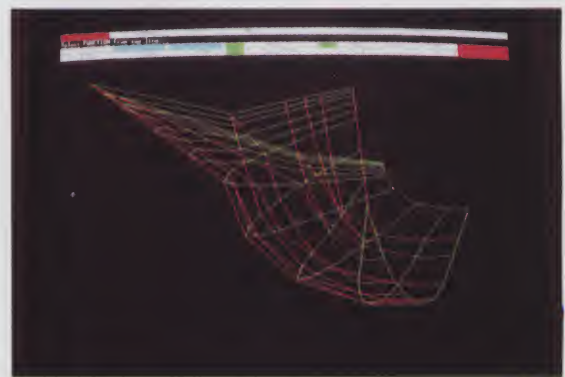
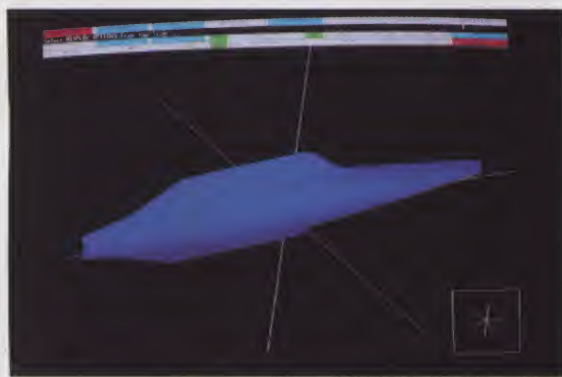
carry more sail. And because the keel was so efficient, he was able to decrease its size, making the boat more maneuverable and, at the same time, reducing the wetted surface. Since there is friction where boat and water come in contact, a smaller wetted surface means faster boat speed, particularly in light air.

Lexcen first sketched these radical ideas on paper. Then he fed the geometry of the various keels into the computer, along with the geometry of conventional 12-Meter keels for comparison. The computer code quickly revealed the dramatically increased efficiency—the ratio of lift to drag—of the upside-down winged keel. Lexcen then decided to test two models at the Wageningen basin: one with just an upside-down keel and one with the upside-down keel and wings. The tank tests confirmed the computer's enthusiasm for the upside-down winged keel.

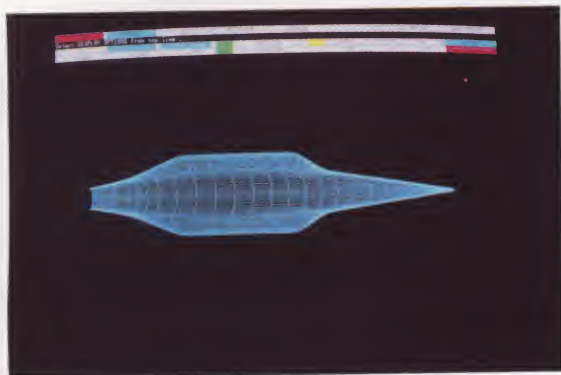
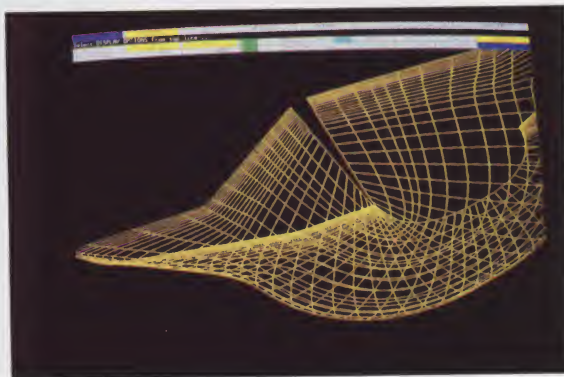
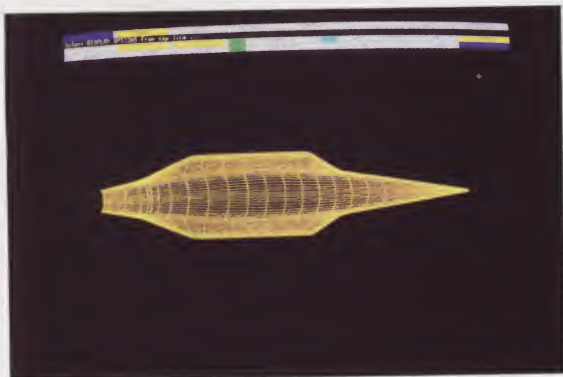
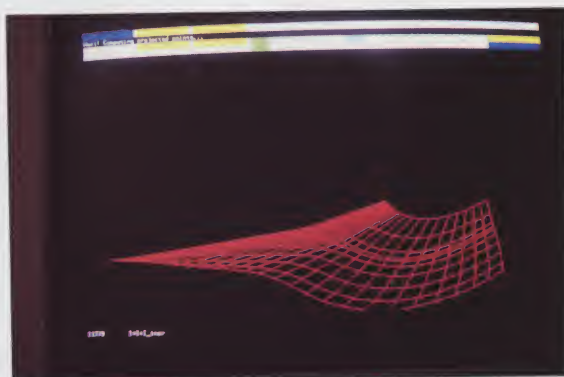
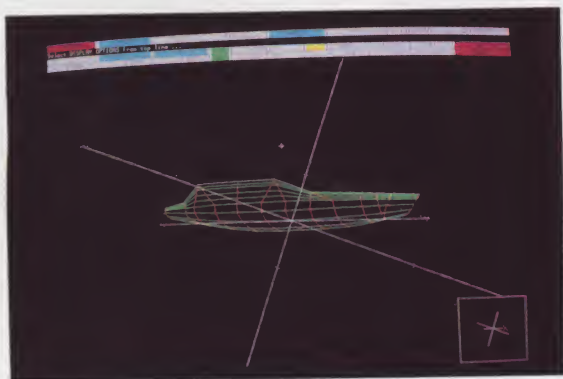
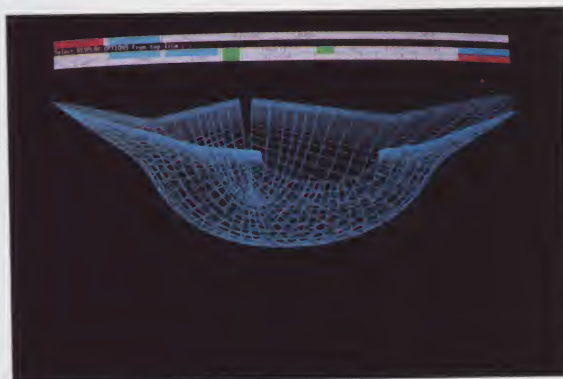
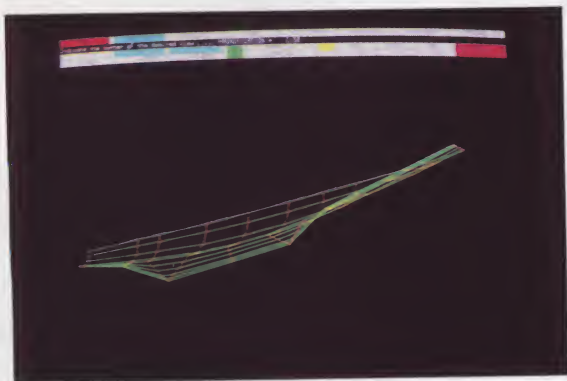
Naval architecture doesn't get any better than *Australia II*, the boat that the computer wrought that year. *Australia II* turned the America's Cup competition on its head. Yacht design had never taken so many giant steps toward one boat, designed with one week of computer time.

"We lost the America's Cup in 1983 because our boat, *Liberty*, was a creative failure," offers John Marshall, who sailed aboard the U.S. boat as tactician. "Simply stated, the Australians made a commitment to a computational approach to design, and America concluded that progress in boat design was unlikely; in any case, it wouldn't be made by peo-

Michael Levitt is managing editor of Nautical Quarterly magazine, and coauthor of Upset: Australia Wins the America's Cup. He is currently cowriting a book on high-tech sails.



SCREEN SHOTS BY DAVID PEREZ



Bruce Farr used Fast Yacht, simple off-the-shelf software, to design *New Zealand's* sleek, if unusual, looks. He then used a velocity prediction program to model its performance.



**“Without a computer
there is enormous pressure
to avoid risk. That doesn’t
win the America’s Cup.”**



The San Diego team's hard-sail catamaran.

ple playing games with computers. It would be made by hands-on sailors, intuitively modifying and adjusting. And I'll tell you what, the number crunchers won."

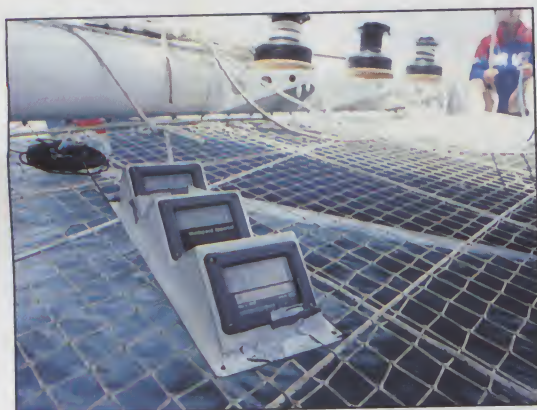
The next America's Cup was the first held outside of this country. Marshall, currently head of Hinckley Boats in Maine, was named design director of Dennis Conner's Sail America syndicate, which represents the San Diego Yacht Club. Explains Marshall, "For the 1986 to 1987 Cup, we said, 'The Australians were right. If that's the game they want to play, watch this!'"

What has followed has been an unparalleled commitment to computer-aided design (CAD), which centered on yacht design and also touched upon complex areas such as sail making, weather as it affects boat design and race strategies, and tactical decisions on the water. If Lexcen was wary of computer technology, San Diego embraced it as modern yacht design's best friend.

Having lost the Cup in a boat that represented an evolutionary dead end, San Diego paid special attention to first developing an improved velocity prediction program.



Above: Sail America's soft-sail catamaran in the foreground, followed by the hard-sail cat. **Below:** The U.S. team's on-board instruments.



Stars & Stripes:

The multihulled defender.



PHOTOGRAPH BY DAN NERNEY/DOIT

Dennis Conner of Stars & Stripes.

Marshall describes the search for a better VPP: "We decided to approach the whole thing in the toughest way, but ultimately, I think, it is the only way to do creative yacht design. We went back to the science and asked the question: If the VPP isn't working perfectly—if it's not giving us numbers that we know correspond to our experience in the real world of 12-Meter yachts—is there something fundamentally wrong with the physics underlying the model? Is it bad science?" This sort of critical thinking yielded a better computer model, based on better physics.

Simply considered, the VPP is fed geometrical data for both the boat and the sail plan. It outputs a prediction of boat speed and the boat's angle to the wind as a function of wind speed and wind direction. Designers use the results to compare and rank various ideas. San Diego tested 400 ideas in a VPP running on a Cray X-MP/48 supercomputer, tested more than 40 models in a Southern California test tank, and built four full-scale boats to test ideas that looked most promising in both the computer and the tank. The VPP's numbers also could be used as sailing targets, or target boat speeds, to help optimize yacht performance and, conversely, to help fine-tune the VPP.

When testing their four race boats (each named *Stars & Stripes*), San Diego sailed with a Hewlett-Packard 71 and later a Data General One laptop computer. On board, sailing instruments indicated boat speed, wind speed, wing angle, and heel, and these readouts were instantly compared with the target boat speeds and the VPP numbers. Those same readouts were then sent via telemetry to a Digital MicroVax II computer located on a powerboat following the racing yacht, and the larger computer

logged the data.

Once ashore, this information was analyzed by another MicroVax II. San Diego compared the difference in targets in order to tune the boat; the designers were able to tune their VPP, making it an ever more powerful tool.

During the actual races, computers told the San Diego team which boat was ahead—not always an easy task when boats on different tacks can be sailing away from each other at right angles, often hundreds of yards apart.

An electronic compass measured the bearing of the enemy yacht from *Stars & Stripes*. An optical range finder, called a stadimeter, measured the distance. When the tactical situation warranted it, this gun would be fired at the opposing boat as often as every 15 seconds.

Using a Loran-like positioning device, the on-board computer knew where *Stars & Stripes* was and where the next mark was. With a little number crunching, it told the U.S. team which boat was ahead and by how much. The “how much” could be measured in boat lengths or degrees—very important in sailboat racing, in which a wind shift of a few degrees can scramble positions.

Although the technology for this type of testing and measurement is on the leading edge, the hardware San Diego used was born of ad hoc engineering, or “funky-looking stuff,” according to Marshall. “A lot of stuff that works in the real world is patched together, soldered here and there, and eventually you get the job done in the time available. In the beginning we had a thousand ideas how to do the job perfectly, but they all involved NASA-level contracts and wouldn’t be ready for four years. Meanwhile, the missiles had already been launched. We weren’t ready for Star Wars; we just needed some sort of butterfly net to catch the damned missiles.”

And catch the missiles they did. With its better boat and more sophisticated computer programs to help in the workup and the sailing of the boat, San Diego won the twenty-sixth defense of the America’s Cup.

The twenty-seventh defense is undoubtedly the strangest story to date. It began when Michael Fay, an investment banker from New Zealand, put a strange proposition on the table: to sail the America’s Cup in the largest boats possible (90 feet on the water, or twice as big as the 12-Meter, which measures 45 feet on the water).

Salient legal issues were brought before the New York Supreme Court: Did New Zealand have the right to challenge in an oversized yacht rather than in the familiar 12-Meter variety? If so, did San Diego have the right to meet this huge monohull in a delicate multihull? Two more different boats are hard to imagine.

Bruce Farr, a Kiwi living in Annapolis, Maryland,

designed Fay’s superboat. Part of the team that shaped *Kiwi Magic*, which sailed so well in the last America’s Cup, Farr is probably the most successful yacht designer working today. When Fay, who previously organized the *Kiwi Magic* campaign, outlined his new challenge at the Ritz-Carlton Hotel in Washington, D.C., last July, Farr immediately headed for his office computer, a Hewlett-Packard 330-C.

The software he used to model the 90-footer is an off-the-shelf package called Fast Yacht. Farr sees the computer as a “valu-

A computer keeps tabs of more than 90 strain gauges connected to all rigging elements. When the going gets tough, the computer can read the loads 50 times per second.

able tool” in yacht design, but he is not yet ready to burn his pencils or his splines. Asked how big a computer a yacht designer needs for this type of work, Farr answered: “about two feet by three.”

The boat Fay was suggesting and Farr was shaping was so long, so light, and carried so much sail area, the VPP had some trouble digesting it at first. “Some programming work had to be done,” acknowledges Farr in his slight New Zealand accent gone soft from living in the States for eight years. Once the program stopped looking cross-eyed at the numbers, Farr tested ten variations on Fay’s 90-footer theme. Within three days he gave Fay the four numbers needed to present his America’s Cup challenge to the San Diego Yacht Club. The boat would be 90 feet on the water, show a keel 21 feet in depth, show a beam (width) of 14 feet where the hull touches the water, and have a beam-max (maximum width) on deck of 26 feet.

The yacht club officials at first rejected Fay’s challenge. Fay, a man who cut his teeth on corporate takeovers, took the matter to court. Then, like the high-stakes gambler he is, he commenced building his superboat as if the judge’s decision were a fait accompli.

While CAD has found a very sophisticated application in yacht design, computer-aided manufacturing (CAM) hasn’t. Farr had his computer draw plans for the boat on Mylar panels, which were sent to the builder, Martin Marine, in New Zealand. “The computer produced full-sized drawings of the boat,” says Farr. “It’s still basically a drafting function; it’s not like we sent the builder a computer tape.” While

awaiting the judge's decision several computer tests of the hull, keel, rigging, and rudder were being conducted at Auckland University.

On the day before Thanksgiving last year, Judge Carmen Ciparick told San Diego, in essence, to put up or give up the trophy. It proved not to be a pleasant autumnal feast for the members of San Diego's design team.

John Marshall recalls the early brainstorming: "First of all, we had to ask ourselves what this New Zealand boat was like. We had these four dimensions, but they didn't help much. Those dimensions could be a big monohull, or they could also be a big trimaran."

Marshall's team reasoned that it might be a trimaran because the two beam measurements might de-

Three video cameras mounted at or near the top of the mast of New Zealand "see" the shape of the sails every three-tenths of a second.

scribe the main hull of a trimaran rather than the outside hulls or outriggers, which float out of the water when the boat is not sailing. "We had to disregard the other boat, because we really didn't know what it was. We had to ask the question: If our job is to go 20 miles to windward and return, as the course spelled out in the rules, what's the fastest thing we could come up with?" That led San Diego to a catamaran, and to shape it, the designers turned to their beloved VPP.

Most VPP programs are aimed at monohulls, with lead keels that resist the heeling forces in the sails, rather than multihulls, which rely on wide platforms.

When Marshall and his team of designers (which included Britton Chance and Bruce Nelson, both of whom were involved in the 12-Meter design effort for the last America's Cup defense) and multihull specialists Duncan MacLane, Dave Hubbard, Randy Smyth, Gino Morelli, and Bernard Nivelt fed the multihull's numbers into the computer, "It was not happy at all," Marshall recalls. "It just blew its lunch over a multihull. It lit up and said, in essence: 'All the boats I've ever met before in my life were nice ordinary girls—keelboats, where the more you tipped them, the stiffer they got. You tip this multihull and it gets stiffer; you tip it a little more and it gets really powerful, and you tip it more, and it tips over. I can't deal with that.'" A stranger in a strange land, the VPP would vibrate between two different solution routines.

There wasn't sufficient time to teach their VPP about multihull physics, so San Diego's Sail America found a multihull-specific VPP developed in Europe from empirical studies of existing offshore boats. With no presumptions to science, it said things like, "If you add 5 percent more sail area, you're going to go x percent faster."

Most important, says Marshall, was the empirical data collected by Duncan MacLane and Dave Hubbard, designers of several C-Class catamarans. These 25-foot boats typically sport an articulating wing rather than soft sails and are the lightest, probably the fastest, and unquestionably the most complex catamarans in the world.

Combining Sail America's VPP with the empirical multihull VPP and the C-Class numbers "gives you a band of information about multihull design where all the people involved are reasonably confident," explains Marshall. Those high-tech tools and a "Quaker-meeting approach" to differences of opinion helped San Diego to design the new boats.

San Diego decided to build two catamarans: one with a wing sail like a C-Class cat and one with soft sails. The syndicate has built two solid sails made of carbon fiber and closed-cell foam. They were built by Sail America's MacLane and Hubbard, and Burt Rutan (who also built the Voyager plane that his brother Dick Rutan and Jeanna Yeager flew nonstop around the world).

The larger of the wings is 96 feet long, contains approximately 1,500 square feet of projected area, and is about the size of a wing on a Boeing 757. Otherwise, the boats look identical: they show razor-thin and feather-light hulls made of carbon fiber and Nomex honeycomb. Dennis Conner, the skipper, firmly believes in a two-boat program, as it allows each boat to push the other to the next-highest level of performance.

The New Zealand boat (named simply *New Zealand*) flies alone, however, and computers must push it during its workup. A Hewlett-Packard HP 9000 Model 330 computer, fed data from a Model 220, processes three types of information: performance data, sail analysis, and structural analysis.

Sail analysis, or sail vision, is most interesting. A similar system was first used on the Australian 12-Meter *Kookaburra*, which lost the 1987 America's Cup, but the system reportedly had some problems handling changing light conditions and excessive movement of the rig.

Three video cameras mounted at or near the top of the mast of *New Zealand* record the shape of the sails every three-tenths of a second. The sail geometry is then fed into a third computer, an HP



The multiple-surface-definition version of Fast Yacht was used by the San Diego team to generate this image of Stars & Stripes.

Vectra PC, which provides real-time performance, sail-trim analysis, and historical data. Thus, if the huge yacht isn't reaching its target boat speeds, target sail trim can be called up on the computer for comparison. The sail shape can be superimposed on the present shape on the computer screen to duplicate trim.

There has never been a boat like this before. *New Zealand* is 133 feet overall, flies a Kevlar and Mylar mainsail that is 5,000 square feet and has a poleless spinnaker measuring 12,000 square feet; add the headsail, and this amounts to more than half an acre of sailcloth. Although a keelboat, it gets much of its righting movement from the 40 crew members, 20 of whom perch on deckwings on the high side.

New Zealand is so big, so long, and so light that keeping track of stresses and strains on the mast and hull is critical. The computer keeps tabs of readings from 90 strain gauges placed on all rigging elements

and on several critical areas of the boat's hull. When the going gets tough, the computer can read the loads as many as 50 times per second. This information is useful in tuning the carbon fiber mast, which is 15 stories high. The strain gauges also signal overloads in the mast or hull before something breaks.

"The America's Cup has become the ultimate computer game. San Diego's John Marshall, a firm believer in the message of the machine, doesn't lament this in the least. As he explains, "Computers are the tools of the current artists. You can't really conceive of doing creative work in the modern world without computers. With a computer you can substantiate your intuition, you can lay down some quantification of why you should do what you would do anyhow. So you can still have a Michelangelo without a computer, but how would a Michelangelo get something built in today's world? It's damn hard to get anything new built today if you can't document it first. I think without a computer, it is hard to avoid mediocrity. Without a computer there is enormous pressure to avoid risk. That doesn't win the America's Cup, I'll tell you that." ■

instant gratification

ADD TO THE to the elite list of machines that have driven technology through the twentieth century one more: the now commonplace, now PC-linkable fax machine. □ Quickly becoming the business revolution of the 1980s, fax boasts a growth curve that resembles the trajectory of an interstellar probe. From an installed base of only 10,000 or 20,000 machines at the

beginning of the decade, the fax world today includes millions of machines in service. Another million will likely join their ranks in the coming year alone.

Fax—the more familiar moniker for “facsimile transmission”—moves hard-copy images over the same wires the telephone system uses to transmit speech. If you want to send a document from Hoboken to Hong Kong, all you need do is dial your fax machine exactly as you’d dial an ordinary phone and then slide in the piece of paper you want to send. In half a minute, a likeness

of your original curls out of the fax machine at the other end of the connection, regardless of whether anyone is there to answer the phone.

The fax market is exploding because it has finally reached critical mass. Enough people have fax machines—roughly three million,

PC fax moves hard copy from Hoboken to Hong Kong in half a minute.

By FRANK BICAN and WINN L. ROSCH

at last count—that the machines are now taken for granted.

Sheer numbers alone don’t completely explain the fax revolution. It offers that unbeatable combination of convenience and power.

Operating a fax machine is simple. Unlike some computers, photocopiers, and programmable video-cassette recorders, it doesn’t require an engineering degree. In fact it’s as easy to use as an ordinary telephone.

Receiving a fax is even easier. Your machine simply answers the phone and churns out paper. When the transmission ends, the machine hangs up and waits for the next call. Unattended operation is not only possible; it is the intent.

Fax is also fast. A full page of graphics can swim the Atlantic in 30 seconds. To

squeeze the millions of dots that get scanned into the fax machine and send them across the line that quickly, the fax combines digital data compression with a high-speed modem operating at up to 9,600 bits per second.

Also helping push the fax into ordinary offices is its standardization. Today's digital fax machines understand the signals of all others. You don't have to grapple with communications speeds, converters, or languages. All fax machines obey the rules laid down by the United Nations' CCITT, an acronym from the French for the Cooperative Committee for International Telephony and Telegraphy.

Perhaps most importantly, fax is powerful. Anything you can get on paper it can funnel down the telephone line. Architectural drawings, schematic diagrams, typeset proofs—all are equally at home on their almost-instant electronic journey by fax.

The power of fax breaks through language barriers. Because fax is designed for graphics communications, it deals in images rather than in characters or words. You can send ASCII, Kanji, Cyrillic, or hieroglyphic characters through the same fax machine, mixing them at random. Fax handles even the least-decipherable means of hard-copy communication—handwriting—such as the signature at the bottom of a contract.

Best of all, fax is cheap. Sending that page across the country costs less than \$1. The alternative, the overnight courier, costs about ten times more. Little wonder Federal Express tried to cash in on the competition with its ill-fated Zap Mail program, which was based on Group IV-equivalent fax equipment.

Of course, the cost savings depends on the job. Imagine sending the galleys of a book to an author for corrections. At two pages per minute, a 400-page book would take three-and-a-half hours to send and cost roughly \$50, even at bargain phone rates. Overnight delivery might cost 20 percent of that, take just a few hours longer, and be more readable.

PC-to-Fax Power

Quick, fast, and convenient, the concept of fax hardly seems possible to improve upon. But, wouldn't you know it, there is a way: by coupling fax with a PC.

On the surface, PC-to-fax systems don't look like much, especially if set alongside their bulky dedicated counterparts. In general, they comprise nothing

more than a single expansion board that hosts a fax-compatible 9,600-bps modem. Many PC-to-fax systems can do double duty as ordinary modems that let you communicate with bulletin boards, online databases, and the like.

But PC-to-fax systems supersede the virtues of ordinary fax. They have all the benefits of standard fax equipment, with added advantages wrought from greater programmability and data manipulation abilities.

Programmability means the PC-to-fax system can process lengthy lists of commands automatically. The PC-to-fax combination can be the Satan of demon dialers, letting you blitz the entire Washington bureaucracy with your latest policy beef or (more likely) reach everyone in your company's foreign offices with the latest communiqué.

You can stack up a series of files, each one to be sent to a different person, then order your PC-to-fax system to swing into action after 11 P.M. when telephone rates plummet. Or you can program the PC-to-fax system to poll distant fax machines—that is, call them and request that they transmit documents to you.

But the PC-to-fax connection doesn't stop with Touch-toning numbers down the wire. Chances are that you're already creating on your PC the documents you want to fax, be they blueprints peeled off AutoCAD, newsletters pressed from PageMaker, or artwork dripped from PC Paintbrush. PC-to-fax technology lets you take anything on your PC's screen and blast it to any fax machine worldwide without first detouring to hard copy.

The PC-to-fax link works both ways. On the receiving end, your properly equipped PC can substitute for a fax machine. It can pull reams of letters off the line at any time, so you needn't worry about running out of paper. (Instead, you'll have to worry about depleting your disk space, but that's what 100MB hard disks are for.) With your PC on the receiving end, you can preview the fax you receive before you waste time and paper printing anything out.

The computing power of your PC also can manipulate fax images before you transmit them or after they arrive. Most fax systems let you take graphics files saved in a compatible form (PC Paintbrush files seem the most favored today) or captured from the screen and transmit them in fax form. Using a paint

program or the graphics editor built into the fax program, you can alter outgoing or incoming fax images.

Image manipulation doesn't stop there. Universally, PC-to-fax systems can convert text files into images that can be sent to fax machines. Not only does

your PC build the proper dot pattern for each letter and number in the file, but it carefully aligns the dots of each character with the dot generator of the receiving fax machine. When printed out, these text-to-fax images may appear distinctly sharper than

Minding Your Fax Manners

Whether you use a "real" fax machine or a PC hooked up to a scanner to send page images, or simply feed an ASCII text stream through a PC fax board, you'll want to adopt one trick experienced fax users find invaluable: attaching a fax cover sheet to direct your outgoing faxes to the right people at the receiving end.

It's useful to think of this as a kind of fax etiquette, both because it follows the procedure generally used in business and also because it's a courtesy to those to whom you're sending faxes. You can get a lot of mileage out of that cover sheet beyond simply routing your message to the right person.

A fax machine at an office typically sits unattended on a desk or perhaps in a closet. From time to time, someone stops at the machine, collects the incoming faxes, and tries to gather the pages of each document (or cut apart a roll-fed fax machine's long scrolls) and deliver them to their intended recipients.

Without a cover page for each document, the poor soul who has to sort out and deliver incoming faxes is going to have a devil of a time figuring out to whom they should go, let alone whether the right numbers of pages have been received. Like as not, your document may wind up on the bottom of the stack, undelivered, its pages out of order.

Enter the fax cover sheet. A cover sheet needn't be fancy. At minimum, you may simply scrawl "To:" and "From:" on a separate plain sheet with a felt-tip pen and send that as the first page of your mes-

sage. If you're sending a text file directly from your PC, without first putting it on paper, "To:" and "From:" lines at the top of the file may be sufficient—and about all that's possible. (Consider using a keyboard macro program, such as SuperKey, to reduce your form to a chunk of boilerplate you can insert at the top of text files with a couple of keystrokes.)

But if you're sending the message on a standard fax machine or from a scanner tied to your PC, why not take a few minutes to create a decent-looking fax cover sheet? Our sample cover letter was prepared on a Macintosh with MacDraw, but could easily have been done on an IBM PC or compatible with any text or text-and-graphics program.

The sample includes several items you may want to include in your cover sheet:

- The name of the person to receive the fax, with his or her title, department, office number, floor, and phone number.
- The number of pages in the transmission, including the statement that the cover sheet is counted as page one.
- The time, date, and perhaps day

of the week the fax was transmitted.

- An optional request to confirm that the fax was received in complete and legible form.
- An optional request for the recipient to make and distribute copies of the fax.
- The name of the person sending the message, with the name, address, and telephone number of the sender's company.
- Explicit instructions for sending a

Urgent FAX!

Please deliver at once to

Name _____ Dept. _____
Office _____ Floor _____ Phone _____ Ext. _____

This is page _____ of a _____-page transmission.

Time Sent _____ Day/Date Sent _____

☐ Please call _____ at _____ to acknowledge receipt of this Fax.

☐ Please distribute additional copies of this Fax to the following persons at your location:

Received from Maury Weitz, Portland, Oregon

For return Fax, dial 309-555-1212

But call that number first on a voice line to confirm that the Fax equipment is online, ready to receive.

return fax, including your fax's telephone number and, if necessary, a request that senders call another number first to confirm that the fax machine is online. —Jim Seymour

those scanned into an ordinary fax machine.

A few PC-to-fax systems even add the luxury of optical character recognition (OCR), converting the text images sent to you via fax into ASCII files, which you can edit with your word processor.

A scanner and printer complete the configuration, one that virtually replaces traditional fax systems. By coupling a PC-to-fax system with an image scanner (which you generally must buy separately), you can capture images from hard copy for editing and transmission. And you can print incoming faxes to any graphics-capable printer compatible with your particular PC-to-fax system.

Your Choice: PC or Standard Fax

One place where PC-to-fax falls short of the stan-

dard fax machine is in its ease of use. Operating a fax machine requires little more than turning it on, punching in a telephone number, and sliding in a sheet of paper. PC-to-fax demands enough computer savvy that you can boot up your PC and work your way through its software. Negotiating through sever-

A few systems convert text images sent via fax into ASCII files.

al layers of menus, and maybe even capturing hard copy with a scanner before you post your transmission, can waste time and resources.

The Fax Phenomenon Spreads

It may just be more urban apocrypha, but it's too good a story not to be true: a delicatessen on Wall Street has put in a fax machine.

All the usual advantages of facsimile transmission apply—as long as the hungry sender remembers to put the right name and address on the order. Calls for corned beef move at 9,600 bits per second, faster than a human order taker could write them down. Hard copy is generated automatically. Arguments over an extra tuna on whole wheat in an office's take-out order virtually disappear.

Thus, the number of potential customers is growing by leaps and bounds as the fax phenomenon spreads.

David Simons hadn't heard the digital deli story before, but he believes it. Simons develops product marketing strategies for major telecommunications companies from his John Street office in the heart of Lower Manhattan's financial district. And the ubiquity of fax is beginning to get on his nerves a bit. "I don't have a fax machine as a matter of principle—I'm in the interactive

services business," he says. "I hate it when clients ask me to fax them something."

That doesn't mean Simons is ignoring fax technology. "I'm watching the home office very closely. There are four million businesses operating out of homes in this country. When fax comes down to the \$500 range—as it will very shortly—the result will be tremendous." Simons believes that at that price, home fax machines will be as common as VCRs.

Mary Stanley knows what it's like to have a fax machine at home. She's vice president of Qualitas, Inc., and with her husband, Bob Smith, she runs one of those four million home businesses.

The fax machine came into their house as office equipment, but it's serving personal uses as well. In fact, the real implications of fax hit her when a friend faxed her a recipe for tapas. "Her husband is a corporate executive in the computer industry," Stanley says. "He got a fax for home because it's 45 minutes to his office. The fax is faster and easier if he forgets a piece of paper."

In spite of her husband's profes-

sional interest in computers, Stanley's friend "has refused to have anything to do with PCs," Stanley says. But to send the recipe "she just wrote out her notes and sent it to me. That's when it clicked for me that fax is going to be great for families."

Stanley found other personal uses for fax. Deciding late one night that she would go to the beach the following day, she sent an invitation to a fax-equipped friend. "I wouldn't have called her at 11:30 at night!" she says.

Fax can also do an end run around errors that creep into messages taken over the phone, she says. "You know the directions are going to be correct when you write them out yourself."

Ads from manufacturers such as NEC are already touting top-of-the-line machines as a sort of all-purpose desktop appliance—phone answerer, fax transmitter, and photocopier. As these features appear on cheaper units, little Jimmy's nursery school drawings may displace sales reports and memos as a source of fax traffic.

—David DeJean

If you don't really need all of the features of PC-to-fax, you may end up spending \$5,000 on hardware and taking four times as long to do what a budget-priced \$1,000 dedicated fax machine can do. Fax is a technical marvel, but its real value depends on whether you have sufficient need for it. PC-to-fax is

not for everyone or every situation.

Nearly every PC-to-fax system has its own personality, its own strengths and weaknesses. Choosing one from the dozens now available is mostly a matter of matching individual features with the way you work and expect to use fax.

4 fax picks

THE SELECTION of PC-to-fax boards has grown tremendously over the past few years. You've now got over a dozen brands from which to choose. □ To guide you along, we offer our hit parade of four top-notch PC-to-fax systems. Each one is outstanding in at least one area of fax technology or application—in speed, power, convenience, or price. One of them may be the right system for you.

IntelliFax

The Brother International Corporation

If you're looking for a complete communications system in one package, Brother International's IntelliFax is what you want. In addition to a powerful PC-to-fax system and a Hayes-compatible 1,200-bit-per-second modem, you get all the software you need.

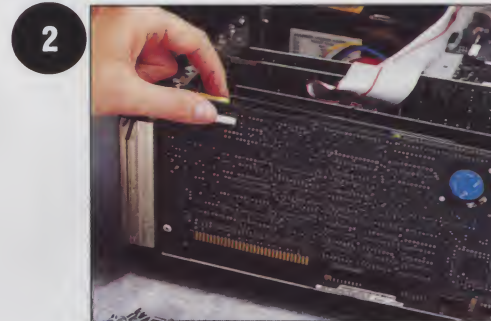
The only flourish missing from this complete package is a bow.

Brother, based in Piscataway, New Jersey, is a name that may be familiar to you from the company's line of office typewriters and printers. Its IntelliFax is built around a very smart PC-to-fax board. Based on an 80188 microprocessor, it can run full-speed fax

HOW TO INSTALL YOUR FAX: Turn off your PC and disconnect all cables. Unscrew the back and slide off the cover. Choose an empty card slot and remove the silver backplate blocking the opening in the rear.



Before inserting the card, check your manual to make sure that the jumper switches (indicated here) are set properly. Check the dip switches too (surrounded by red plastic)—they may also need adjustment.



PHOTOGRAPHS BY JOHN VAN-SCHALKWYK

operations in the background without slowing down your PC.

Control software for the \$995 IntelliFax system was codeveloped with Asher Technologies, the same company that supplies the software for Quadram's JT-Fax, but the top performance of the IntelliFax microprocessor gives the system an entirely different feel—you don't have to give over your system to fax operation. Just preprogram IntelliFax and go on to your other computing chores. You can be busy slaving over your desktop publisher while the IntelliFax is quietly transmitting or receiving fax files.

The software—and thus the complete IntelliFax system—is easy to use, with nested menus, a phone directory, transmission scheduling, context-sensitive help, and the ability to transmit documents without prior conversion to fax format. But you pay a significant penalty for its concurrent operation: 155K of main memory.

When you want to send ordinary text files, you can bring the built-in modem to life with SoftKlone's Mirror communications program, included with IntelliFax. While hardly state of the art (basically it's a Crosstalk XVI look-alike), Mirror still gets the job done. If you don't like the way Mirror feels, you can substitute your own favorite communications program in its stead, since the IntelliFax modem is Hayes-compatible.

Installation requires setting the eight on-board switches that control communications between the fax board and your PC, so expect to become intimately familiar with the well-written manual. Just be careful with the volume control for the on-board speaker mounted on IntelliFax's retaining bracket. It looks and feels as delicate as a prehistoric eggshell.

If you want to avoid communications mix-and-match worries, yet long for a complete fax-and-data communications system, Brother's IntelliFax is the most complete package you can get that doesn't sacrifice full fax power.

GammaFax **GammaLink Synchronous Communications**

It's no surprise that the most refined PC-to-fax product has been on the market longer than any other. With its age comes elegance in the form of a finely honed, hardworking system, the standard by which all other PC-to-fax systems are measured.

Being first usually brings about a few growing pains, and GammaLink's early software was about as easy to learn as neurosurgery. But Gamma Technology—now GammaLink, of Palo Alto, California—has refined GammaFax over its four-year life, culminating in a new software release (version 4.0) that couldn't be much simpler to use.

Even if you're a fledgling faxer, you should be able to start sending and receiving files in less than an hour with the menu-driven software that puts context-sensitive help only a keystroke away. You can execute nearly any function merely by ratcheting a highlighted bar down one of the nested menus using the cursor keys, and then pressing Enter.

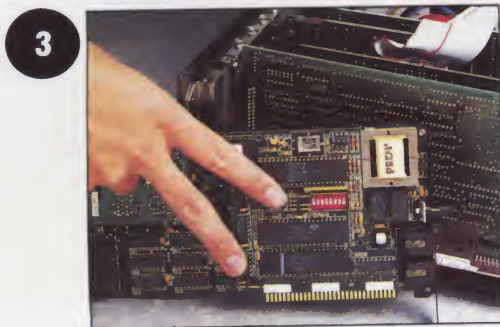
You have sufficient control to edit the phone directory, create lists of files to be sent, view files graphically, and print documents. Ask for the impossible, such as an illegal filename, and a window pops open to suggest help.

For background operation, you run a memory-resident supplementary program called Queue Manager. It stores incoming fax transmissions on your hard disk and keeps a log of every transaction.

Yet GammaFax's newfound simplicity doesn't compromise its time-honored power. If you've spent hours learning and writing command and batch files for earlier versions of GammaFax, they'll still work (with minor modifications) with this newest release. The biggest change in GammaFax's command language is that its reference manual is harder to find, buried in a text file on one of the accompanying diskettes.

Getting full speed from GammaFax requires at

With the gold "fingers" pointing down and the phone line connectors facing the rear of your PC, align the card and press it down into the slot. Slide the PC cover forward and screw it into place.



The phone connectors are now accessible at the rear of your PC where the backplate had been. After installing your fax software, plug your phone lines into your PC and fax at will.



least an 8MHz AT, because the board lacks a microprocessor of its own. Even then, running Queue Manager in the background will substantially slow your foreground work. A version of GammaFax equipped with a 1,200-bps Hayes-compatible modem is also available.

Choose the \$995 GammaFax for its proven power, ease of operation, and long-lived reputation in a fast-changing industry.

Connection CoProcessor Board Intel Corporation

The most powerful PC-to-fax system bears the familiar Intel name, the same label worn by the microprocessor chips at the heart of virtually every DOS-based PC. Not only will it handle your fax chores with aplomb, but its optional Hayes-compatible 2,400-bps modem module puts today's two most important computer communications vehicles in one slot in your PC.

The power of the Connection CoProcessor, priced at \$995 and known during its beta testing as the Calling Card, comes from the board's own dedicated microprocessor (an Intel 80188, what else?). Brains on board means that background file transfers—sending and receiving fax documents while you're in the middle of another application—won't sap your system of any processing speed.

If you're familiar with Lotus 1-2-3, you already know how to use the Connection CoProcessor. Its software displays similar horizontal menu bars with single-line descriptions.

As with most other fax boards, the Connection CoProcessor's software allows you to establish a phone dialing directory and to build a list of transmission commands that will execute automatically at

a specified time (for example, overnight, when long-distance rates are lower). Your lists also can be used to dial up other locations, poll for files to be sent, and, if any exist, transmit them to your PC.

Built into the software is a graphics editor—a version of PC Paintbrush+—that lets you create or modify graphics files before or after transmission. The editor is designed for use with a mouse (not included with the Connection CoProcessor) which can be plugged into a port on the retaining bracket of the board.

If all that isn't enough, Intel is working on a family of communications modules that plug into the Connection CoProcessor's PiggyBack site. The optional \$295 modem is the first of these, but you can expect to see IBM 3270 emulation, voice mail, and network adapters in the future. Intel is also publishing its Intel Communicating Applications Specifications (ICAS)—guidelines for software developers to use in creating applications that have direct access to the Connection CoProcessor's functions.

For all its power, the Connection CoProcessor is easy to get going. Its installation program automatically creates a subdirectory on your hard disk, copies the necessary files, and allows you to select options such as those you use for hardware setup. Unlike other setup programs, Intel's allows you to choose the subdirectory name for your Connection CoProcessor files and gives you the option of automatically modifying your system startup files (Autoexec.bat and Config.sys).

You'll need a hard disk to put the system to work—but if you planned to move up to the world of fax, graphics programs, laser printers, and the like without first having upgraded to a hard disk, then your priorities are a little out of order anyway.

Have Fax, Will Travel

▶ Using your PC as a fax machine is appealing, but until now laptops have been strictly off-limits. Not that they don't have the power—it's just that most laptops lack the conventional expansion slots found on their desktop counterparts.

Quadram took a look at the problem and figured out how to get around it. The company's JT-Fax Portable sidesteps the internal configuration and provides you with a small external fax adapter. The device connects to the serial port

found on virtually all laptops (and most desktop computers as well).

The back of the compact beige box has jacks for the serial cable (the common DB-25 connector is supplied), the external power pack, the phone line, and an optional telephone handset.

Functionally, the JT-Fax Portable provides you with performance identical to its internal counterpart. It uses simple menu-driven software and is only slightly slower than faxing with a big PC.

Since the JT-Fax Portable is in-

tended to be your traveling companion, Quadram has included a nylon carrying case that holds everything but the manual and diskettes (both 5¼-inch and 3½-inch versions are included in the package).

The price for this flexibility is just \$495. Considering that you can use the JT-Fax Portable with your laptop when on the road *and* on the desktop back at the office, the \$100 premium over the PC-only version could be money well spent.

—Winn L. Rosch

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CIRCLE NO. 120 ON READER SERVICE CARD.

You might accuse the folks at Intel, in Hillsboro, Oregon, of dragging their feet in bringing a fax board to the market; if you're looking for the most powerful PC-to-fax system, however, the Connection CoProcessor has been worth the wait.

JT-Fax **Quadram Corporation**

The most affordable fax around is Quadram's JT-Fax, a \$395 combination of a minuscule expansion board and single software disk. That's less than half the cost of other PC-to-fax systems or even budget fax machines.

The bargain is a good one because the JT-Fax doesn't skimp on features. Quadram, based in Norcross, Georgia, built a system that includes most of what you get with the expensive units, such as off-hour transmission scheduling, phone directories, group broadcasting, transaction logs, and even network operation.

And it even goes beyond some of the more expensive systems. While most other PC-to-fax products

Frank Bican, computer resources supervisor at a Cleveland, Ohio, medical center, is a contributing editor of PC Magazine. Winn L. Rosch is a contributing editor of PC/Computing.

require you to assemble documents before you transmit them (for instance, pasting a letterhead over your text), JT-Fax does it on the fly while you're transmitting.

The Asher software that runs JT-Fax is memory resident—that is, once loaded, it lets other programs run on your system. But when you want to fax something—even in the middle of other programs—you can instantly call up JT-Fax by pressing the Alt-F (or keys of your choice) on your keyboard.

Although memory resident, JT-Fax won't run in the background. When you're sending or receiving fax files, your PC can't be used for anything else.

Hit the hotkeys, and you'll find JT-Fax about as simple to use as a garage door opener. A single opening menu leads to more windowed menus; a context-sensitive help menu pops onscreen at the press of F1.

Where JT-Fax cuts corners is speed. At its fastest, JT-Fax transmits and receives at half the rate of other fax products. Nevertheless, it's still fully compatible with the prevailing standard because other fax products automatically slow down to accommodate its pace.

If you only need to fax files occasionally, JT-Fax will get you into the technology with the minimum outlay. Its slower speed and lack of background operation discourage heavy-duty use. ■

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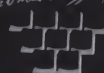
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Unfair Fair Trade

**Who will bear the huge
cost of the U.S.-Japan trade pact?
U.S. consumers.**

Watching U.S. trade officials get tough with Japanese semiconductor manufacturers is a lot like viewing reruns of old "Road Runner" cartoons, with Uncle Sam cast as Wile E. Coyote. No matter how clever, no matter how carefully planned, Wile E.'s schemes invariably backfire. Without exception, the Road Runner escapes unscathed, while the coyote plunges off the edge of a cliff.

The 1986 semiconductor agreement is a classic example. It was designed to benefit all U.S. memory chip manufacturers; it helped only two. Micron Technology, one of only two remaining U.S. manufacturers of dynamic RAM chips (DRAMs) for the open market, recently reported a huge surge in profits. Texas Instruments, the other DRAM maker, is also benefiting from the agreement.

But for the rest of the United States the semiconductor agreement has been a bust. DRAM prices have more than tripled since the pact was signed, and memory chip shortages have forced computer companies to

delay production of new models. Any benefits derived from boosting the profits of the two fortunate DRAM makers have been outweighed by the huge costs imposed on consumers and the computer industry nationwide. "It's a disaster," concludes trade expert Gary Clyde Hufbauer. "A sorry mess," agrees Fred Bergsten, head of the Institute for International Economics.

For consumers the effects are painfully obvious. The cost of add-on memory products has soared to the point that savvy PC owners simply aren't buying. And while computer prices haven't increased recently, for the first time in years they haven't decreased either. Drew Peck, a semiconductor industry analyst for the brokerage firm Donaldson, Lufkin & Jenrette, says higher prices for memory have boosted PC makers' costs by an average of 15 percent. As a result, the days of 30 percent annual declines in the cost of computing are over.

In addition, the memory chip shortage has led some companies, including Hewlett-Packard and Compaq,

By ALAN MURRAY

ILLUSTRATION BY DAVID SUTER



to delay the introduction of new models for fear they won't be able to secure a steady supply of DRAMs. Smaller companies that have to buy DRAMs on the spot market have been hit especially hard. They've had to pay as much as \$14 for chips that two years ago sold for only \$2—and the resulting cost squeeze could push some of them out of business.

Defenders of the semiconductor agreement argue that it doesn't deserve all the blame for recent shortages and high prices. And to a degree, they're right. Unexpected difficulties in converting 256-kilobit DRAM production into 1-megabit production have

It is absurd to argue, as some do, that the semiconductor agreement has not contributed at all to the current problems.

reduced the output of Japanese memory chip manufacturers. The decline in the U.S. dollar has increased the cost of imported chips. And an unforeseen surge in demand has caught DRAM makers off guard. The semiconductor business, after all, remains highly cyclical.

But it is absurd to argue, as some do, that the semiconductor agreement has not contributed at all to the current problems. After all, the agreement's proponents intended to raise the price and reduce the volume of Japanese imports. "There's no question in my mind," says Drew Peck, "that the trade pact has been a major contributing factor" in the DRAM crisis.

"Fair trade" advocates say higher prices are a burden consumers must bear in order to protect American jobs. But that argument also falls flat. In the United States, only 13,000 people are employed in DRAM production—a handful compared with the hundreds of thousands of computer industry employees whose livelihoods depend on a stable supply of DRAMs. A new study by Arthur T. Denzau at the Center for the Study of American Business concludes that the U.S. computer industry stands to lose two jobs from the trade agreement for every job saved.

And how have Japanese chip makers fared under the provisions of the pact? Quite nicely, thank you.

The View from the Bargaining Table

▶ In the early 1980s, Cray Research, based in the U.S., designed a semiconductor and asked Japan's Fujitsu Corporation to produce it. After a long delay, no chips had been delivered. Cray investigated and found an abundance of the semiconductors it had designed. The only problem was that they were inside Fujitsu's new supercomputers.

What happened to Cray illustrates the danger of becoming dependent on a major competitor for the supply of critical components. No corporate manager today would wittingly propose a strategy that resulted in such a dependence. And yet that is precisely the course that U.S. chip users were following before the conclusion of the U.S. trade agreement with Japan.

In 1980 there were 12 producers of DRAM chips in the United States. By 1983 there were only half that many, and by 1985 the number had dwindled to two (not including IBM, which produces chips only for itself). Consequently, most U.S. electronics companies had become heavily dependent on Japanese chip producers. But these producers happened to be the Americans' most formidable competitors in the electronics markets.

The almost total disappearance of the U.S. chip industry was due largely to its inability to absorb the revenue losses caused by successive rounds of Japanese dumping. Of course, the Japanese industry also lost money as a result of its dumping: \$4 billion in 1986–87. But the Japanese producers could afford the loss, thanks to the backing of the Keiretsu, an alliance of such companies as Sumitomo and Mitsubishi. (Such an alliance, like dumping itself, would be illegal in the U.S.) Critics of the trade agreement assume that the massive dumping and the distressed pricing of 1985–87 would have continued indefinitely. This is absurd. Historically, Japanese dumping has always stopped after competitors have

been driven from the market. Moreover, had the U.S. government not concluded the agreement with Japan, dumping petitions already filed or about to be filed by several U.S. chip producers would have been taken to their legal conclusions. Because massive dumping was in fact taking place, there is no doubt that duties would have been imposed, along with a consequent increase in prices.

The question was never whether or not prices would increase. It was always clear that at some point they would. The real issue the trade agreement sought to address was whether, once prices began to rise, there would still be a U.S. chip industry. And, perhaps more important, whether the increased prices would benefit the long-range interests of the U.S. or the Japanese electronics industry.

The agreement preserves a viable, broad-scale U.S. semiconductor industry. Today Texas Instruments and Micron Technology are expanding DRAM production in the United States. Motorola is coming back into DRAMs, and others may follow. IBM has cut its dependence on Japanese DRAMs dramatically, and other users are considering long-term arrangements with U.S. chip suppliers. And, of course, as this new supply comes to market, prices will drop from their current high levels.

The trade agreement takes the long-term view that the Japanese have urged upon us. It promises, and is delivering, a stronger U.S. chip industry—one that will reduce the dependence of U.S. computer manufacturers on their biggest competitors.

—Clyde V. Prestowitz, Jr.

Prestowitz helped to negotiate the U.S. trade agreement with Japan as counselor to the secretary of commerce. He is the author of Trading Places: How We Allowed Japan to Take the Lead.

The agreement in effect created a cartel among the Japanese manufacturers and handed it the power to charge monopoly prices in the United States. It's as if the government had gone to the OPEC nations in 1970 and said, "Listen, to help our oil drillers, we'd like you to band together, cut production, and triple your prices." Voilà! Trade policy.

Japanese computer manufacturers are also basking in the beneficial light of the agreement. Most of them are affiliated with chip makers and can get a steady supply of chips at a low price. In the meantime, their competitors in the United States are struggling to buy memory at astronomical prices.

The irony is that this ill-conceived policy emerged during the administration of Ronald Reagan, whose free trade rhetoric knows no bounds. Reagan, more than any recent president, seems to understand that shots aimed at our trading partners can frequently blow up in our face.

But in practice Reagan's free trade rhetoric has often been ignored. Indeed, the Reagan administration will go down in history as the most protectionist since World War II. That's partly because administration officials sometimes succumb to special pleading from American industry, and partly because they

**And how have the Japanese chip makers fared under the provisions of the pact?
Quite nicely, thank you.**

are trying to calm a Congress growing increasingly active on trade issues. Former White House economic adviser William Niskanen refers to Reagan administration trade policy as a "strategic retreat."

The semiconductor agreement grew out of a combination of the industry's pleading and the administration's concern about congressional interference. Semiconductor manufacturers were growing increasingly agitated about the Japanese dominance in the market for key memory products. And the administration was eager to demonstrate its tough mettle on trade issues in order to head off legislation.

The trade pact also owes its existence to some clever bureaucratic maneuvering by the late Secre-

tary of Commerce Malcolm Baldrige and trade representative Clayton Yeutter. Normally, such matters would be subject to the approval of the administration's Economic Policy Council, headed by Secretary of the Treasury James Baker. But Baldrige and Yeutter negotiated the agreement and secured White House approval privately before taking it to the council. Although Baker, his deputy Richard Darman, and Secretary of State George Shultz all opposed the agreement, their efforts to stop it came too late. The deal had been done.

Were Japanese companies "dumping" chips in the United States? Probably. But the issue of dumping becomes very fuzzy in the high-tech arena. Companies frequently sell new products at prices substantially below cost because they are confident their costs will come down as the market grows and economies of scale come into play. American technology companies use such pricing practices as well, and no one accuses them of dumping.

Moreover, Japanese chip manufacturers probably have a natural advantage in producing memory chips. Most Japanese semiconductor companies be-

long to large conglomerates with ample capital. This makes them less vulnerable to the cycles that plague the semiconductor industry: they can continue to invest during good times and bad.

The U.S. high-tech industry, on the other hand, is fragmented. That may make it poorly suited to produce commodity-like products such as memory chips, but better able to develop new computers and innovative software. Why did we adopt a policy that helps an industry in which the United States lacks competitive advantage at the expense of one in which we do have the advantage?

The DRAM problems won't last forever. Eventually, the industry will shift to 1 megabit memory chips and the soaring DRAM prices of 1988 will be forgotten. But the lessons of the semiconductor pact should be remembered. No matter how frustrating we may find the practices of our trading partners, we should avoid haphazard firing of trade salvos. ■

Alan Murray is chief economics reporter in the Washington bureau of the Wall Street Journal and coauthor of the book Showdown at Gucci Gulch: Lawmakers, Lobbyists and the Unlikely Triumph of Tax Reform.

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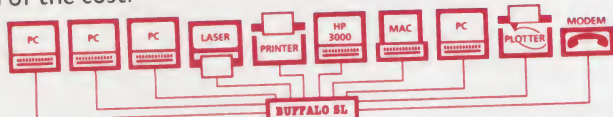


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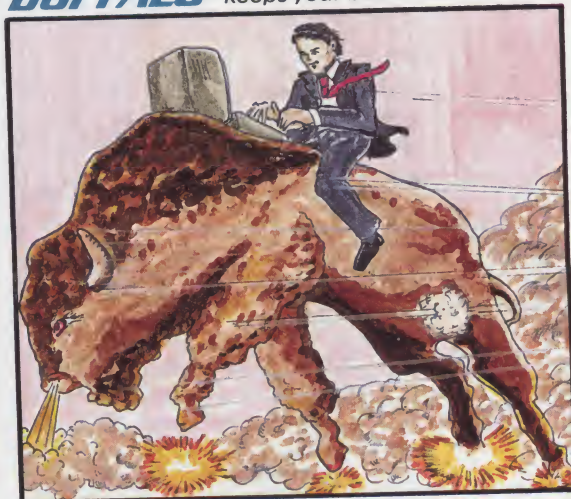
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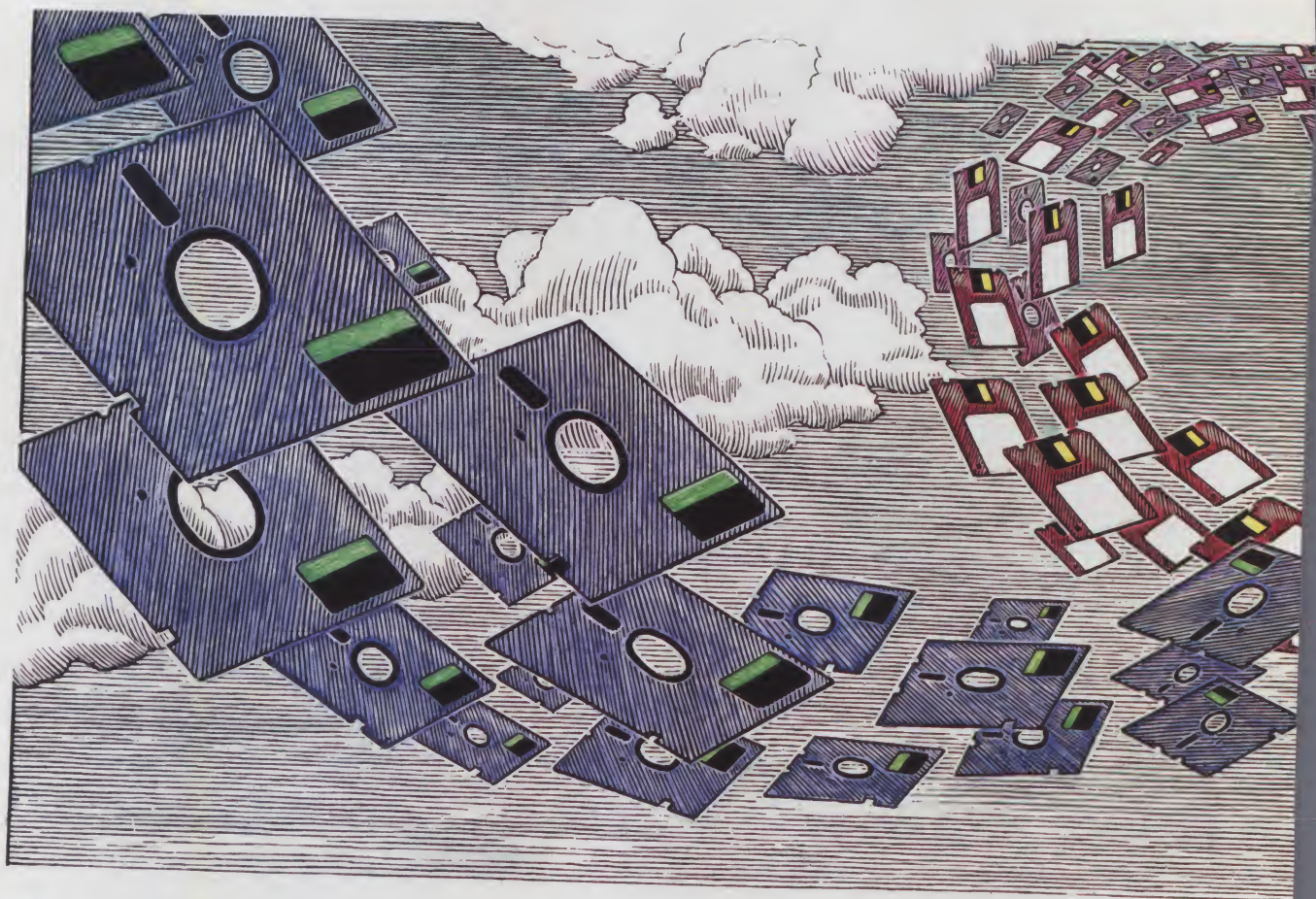
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On Speaking Terms: PC

Free trade is still a long way off, but indications are abroad that the persistent import-export restrictions that have clouded relations between those two microcomputer superpowers, the PC and the Macintosh, are easing.

Trading files between the Mac and the IBM PC and its clones has been like getting through an Iron Curtain—a red-tape snarl of cables and transfer programs, a bureaucratic nightmare of incompatible file structures and mismatched disk formats.

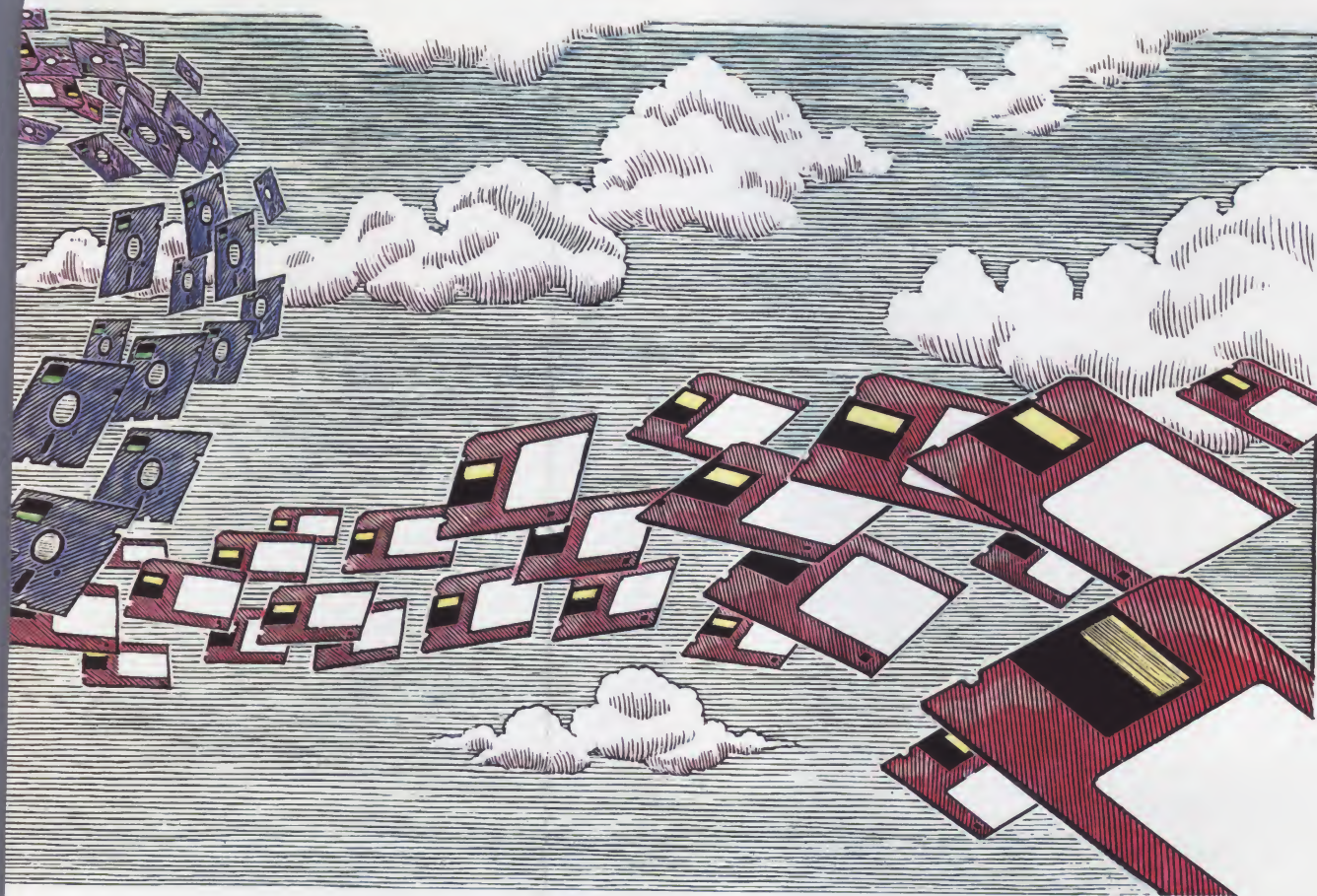
But a digital détente is dawning at last. To be sure, the day when we can take a disk from a Macintosh and put it right into an IBM PC hasn't arrived yet. But the physical transfer is getting easier as wire transfer programs such as LapLink Mac get better.

By **CYNTHIA W. HARRIMAN**

More applications with both PC and Macintosh versions can trade files directly. And for applications that can't, translation utilities and work-arounds are becoming standardized.

Each major type of application—spreadsheets, word processors, databases—has its own problems, and exchanging information between Macs and PCs obviously involves more than just moving a file from one machine to another. It requires, in most cases, translation of a file from the format in which it was saved by the source program to a format the target program can read.

Some of today's improved programs read and write several file formats, making translation unnecessary. Microsoft Word and WordPerfect on the Mac, for example, can read and write in the file format used by their PC equivalents. FoxBase (Mac),



-Mac Connectivity

**A digital
détente is
dawning
at last.**

d-Base Mac, and McMax can read dBase files. Page-Maker (both PC and Mac versions) can create interchangeable files, and Ventura can handle Mac graphics files.

While this is a growing trend, most PC programs cannot read files from Mac programs, and vice versa. Some packages at least include their own translation utilities, such as those bundled with Lotus 1-2-3 and Symphony. Using these external translation utilities is not as convenient as transferring files among programs that can read other formats directly, of course, but they're handy.

If your program lacks its own translation utility, you may be able to use one of a growing number of third-party translation filters. The pioneer in this field was DataViz of Trumbull, Connecticut, whose MacLink program was the first PC/Mac translator

on the market. MacLink is still one of the most widely used third-party translators, although similar commercial and public domain packages are joining the field.

But even third-party translators can't make peace between all file formats. In fact, most of them can read or write files for only a handful of popular programs. If your application isn't one of the chosen few, you may be able to use a common-denominator format, such as DIF or SYLK (see sidebar), as a go-between. The Lotus 1-2-3 .WKS format (for spreadsheets) and the dBase .DBF format (for databases) are also widely accepted as standards.

The absolute lowest of all common denominators, of course, is ASCII. Almost every nongraphic program will let you save and retrieve a file in ASCII form.

ILLUSTRATION BY DOUGLAS SMITH & VIRGINIA PECK

Two caveats are in order, though. Normally, ASCII files include only data. This means that in a word processing document, for example, all the fonts, margins, indents, bullets, and other graphic devices will most likely have disappeared when you call up the translated file. Also, the Macintosh and the PC don't exactly agree on what constitutes a plain vanilla ASCII file.

Every computer adds at least a tiny bit of formatting information to make any file readable. New paragraph markers and tab characters, for example, almost always survive translation, because the ASCII codes for these formatting conventions are nearly universal.

The central difference between Macintosh and PC ASCII files is that the PC puts a line feed and a carriage return character at the end of each line. The Mac doesn't use line feeds; instead, it puts carriage returns only at the ends of paragraphs. So if you send Mac text to a PC, you'll need to break each paragraph into a series of separate lines, lest the PC choke on the data coming in and scream "Input line too long" or some such error message. After feeding PC text to the Mac, on the other hand, you'll have to re-

move the needless carriage return from the end of each line.

Enough of the general issues. When translating word processing documents, spreadsheets, databases, or graphics between the PC and the Mac, it's helpful to start with a few universal truths.

Truth #1: Database and word processing files essentially consist of just plain words, with a few spe-

The absolute lowest of all the common-denominator formats, of course, is ASCII.

cial characters thrown in to separate the words into understandable groups. Both the Mac and the PC read the words in exactly the same way, but they read the separators differently. If you can change the separators so that they match, you'll have easy data sharing.

Truth #2: Physically seeing word processing and database data (including the usually invisible separators) helps you understand your translation task. Mi-

How One Firm Solved the Problem

Give ComputerImages president Gerald Rosenthal a dBase file containing the raw data for your company's fall catalog, and he'll design that catalog without printing out a single record.

ComputerImages is what Rosenthal calls a "full-service desktop publishing firm," offering graphic design and production, training and consulting, and even self-service facilities. Its clients range from government agencies to individuals. Equally broad-ranging are the products it designs, which include books, newsletters, marketing materials, and even business cards.

A principal factor in the success of the two-year-old firm, located in downtown Boston, has been its ability to translate files from the many and varied applications clients use into any one of several desktop publishing formats. Working from a network of TOPS-managed PCs, clones, and Macintoshes, ComputerImages combines desktop publishing tools with traditional graphic arts techniques.

"Say we're going to do a newsletter for a government agency," explains Rosenthal. "Several authors have written articles on the agency's Wang system. They collect these articles, put them on a DOS floppy as an ASCII file, and bring it to us. We would then put it into one of our DOS machines, and maybe copy it to the Mac through the TOPS network. We'd then run it through MacLink Plus, which turns it into an ASCII file. If we were using PageMaker for this project, it could then read that file directly."

It sounds easy, but translation can be deceptive. "Once we were trying to translate a MultiMate document through MacLink," says Rosenthal. "The client used both IBMs and clones. Every time we tried to bring the file up, the system would crash—we got the equivalent of snow and a buzzing noise on the monitor. I know that the problem was with their document because I had them make different copies of it. Two of the four files worked; the others didn't. It meant that we had

to have them put the files into an ASCII format and work from there."

The problem? Probably a compatibility glitch between the client's clones and PCs. But who can be sure? Users rarely have either the time or expertise to search for the cause of such difficulties. The solution—if there is one—inevitably entails one or more additional steps in translation, a time-consuming process that may yield a somewhat garbled result.

"Eventually there will be a fairly uniform operating system for all machines so that translation will become irrelevant," speculates Rosenthal. Meanwhile, you can save yourself a lot of trouble by shopping for software that comes with good translation utilities. "Software vendors are beginning to take it for granted that people will want to translate files," Rosenthal explains. "The first thing we look at in making a software purchase is what utilities it comes with."

—Marty Jerome

Microsoft Word performs this job nicely on both the Mac and the PC.

Truth #3: Spreadsheets are a nonissue, because Lotus 1-2-3 and Excel trade data so easily.

Truth #4: Graphics are a world unto themselves. You'll have to use a translation utility to exchange graphics data.

Word Processing

Almost any formatted word processing file can be exchanged between the Macintosh and the PC. Microsoft Word and WordPerfect files can be traded directly. Other files are easily traded, too, largely because of the popularity of the MacWrite and Microsoft Word formats on the Macintosh and Document Content Architecture (DCA) on the IBM.

DisplayWrite, WordPerfect, MultiMate, and Manuscript, among other PC word processors, can all read and write the DCA format; if not, they come bundled with the necessary translation utilities. Microsoft Word was the first Macintosh program to offer a DCA conversion option, but it requires you to use a Save As command in Microsoft's own Rich Text Format (RTF). Then you use a DCA conversion utility from outside Word. So much for convenience.

Early this year, WordPerfect became the second Mac word processor to jump on the DCA bandwagon. Until other Mac packages adopt DCA, you'll have to use MacLink Plus to convert from the MacWrite format to DCA. MacLink Plus can also take you from MacWrite into IBM's versions of MultiMate, WordPerfect, WordStar, XyWrite, and Office Writer. Remember: the fewer the intermediary steps, the cleaner the translation.

In fact, if you can live without all the formatting information—or can supply your own program's codes after the translation—you might consider working on the ASCII level. This format is especially useful when you're trying to pull an e-mail document or information from a spreadsheet or database into your word processing package.

MacWrite and Word let you easily insert line feeds into files destined for the PC. Scores of shareware utilities in the Macintosh community promise to re-

Cynthia W. Harriman is the founder and director of the Summer Computer Institute. She is coauthor of The Macintosh Advisor: Essential Techniques for Experienced Users.

File Formats for Bridging the Gap

▶ A single standard won't emerge anytime soon, but several widely recognized formats make file translation easier:

DIF: Data Interchange Format was the first common standard, promulgated in the PC community by the creators of VisiCalc. Many spreadsheets and databases offer it as a read/write choice.

SYLK: SYmbolic LinK, Microsoft's standard, works as a common denominator between any Microsoft program on the PC and the Mac.

DCA: Document Content Architecture, also known as RFT (Revisable Format Text), is IBM's standard for exchanging word processing files. It's beginning to show up in Macs as well.

RTF: Rich Text Format is similar to DCA in its ability to exchange formatted word processing files. So far, it's only an intermediary step between Word files on the Mac and DCA files.

TIFF: Tag Image File Format is an Aldus Corporation product for scanned images. A small but growing number of Mac and PC graphics and layout programs are beginning to use it.

EPSF: Encapsulated PostScript Files provide better screen images and slightly faster printing by storing PostScript code inside a file. It's new, however, and cannot be written by all graphics programs. —CWH

move the line feeds from PC text files after they've been imported into a Mac. But the test of a cleanup utility lies in how it deals with carriage returns. There's an art to removing end-of-line returns without removing the paragraph endings too. If you're especially fond of chump work, you can strip or insert line feeds manually by way of a word processing package that allows you to not only view but also search and replace invisible characters.

Spreadsheets

There's no need to agonize over spreadsheet translation—as long as you're using Lotus 1-2-3 or Microsoft Excel. This may sound rather totalitarian, but aside from the fact that these programs are far and away the most popular spreadsheets for the PC and the Mac, respectively, they can exchange data readily.

The process is simple. Excel users need only save their spreadsheets in the .WKS or the .WK1 form using the Save As command; Lotus 1-2-3 (release 2) can read these spreadsheets directly. Excel programs saved in the SYLK format can be read by several other PC spreadsheets as well (including Microsoft's Multiplan).

Since 1987, Microsoft has sold a PC version of Excel that writes files that are readable by either Excel for the Macintosh or 1-2-3. But for all this compatibility, we still live in an imperfect spreadsheet

world: graphs and macros are generally not interchangeable.

Databases

First the good news: Since databases are composed mostly of text—with some method of field and record separation—it's quite convenient to exchange core data. The bad news is that forms, reports, turn-key application information, and all the ancillary tasks we like our databases to perform generally get lost in the translation.

Furthermore, Macs and PCs manage databases differently. PC databases tend to emphasize computer performance, forcing users to decide when they create a file how much space to allot to each field and making it awkward to add or delete fields. The payoff is the speed with which the computer sifts through elephantine databases.

Mac databases tend to be designed with human performance in mind. You rarely have to commit to field lengths, and you can add or delete new fields without tedious database restructuring. But you generally pay for this flexibility with slower searching,

sorting, and other operations.

What these discrepancies mean for data exchange is that the two machines store records in different ways. The Mac's typically variable-length fields are delimited by tabs; the PC's fixed-length fields are usually separated by commas. So translation entails

The bad news is that many of the formatting commands we want in our databases get lost in the translation.

comma-delimited records versus tab-delimited records and fixed-length fields versus variable-length fields.

On either machine, Word makes a good text editor for transforming databases that have been saved as ASCII files. Unfortunately, a few simple search-and-replace commands—to change commas to tabs or vice versa—are just the beginning. In a PC-to-Mac

Where to Get Translation Software

Word Processing Utilities

MacLink Plus

\$195

DataViz, Inc.
35 Corporate Dr.
Trumbull, Conn. 06611
(203) 268-0030

Macify

\$20 shareware fee
Eric Celeste
358 North Parkview
Columbus, Ohio 43209

Convert Text

\$35
William R. Cook Consultants
239 Demarest Ave.
Closter, N.J. 07624
(201) 767-0176

Database Utilities

Microsoft Word

for the Macintosh (\$395)

Microsoft Word

for the PC (\$450)

Microsoft Corp.
16011 NE 36th Way
Box 97017
Redmond, Wash. 98073-9717
(206) 882-8080

Apple File Exchange

Included with system software
Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, Calif. 95014
(408) 996-1010

Evolutions

\$10 shareware fee
Emerald Consulting Services, Inc.
2707 N. Loop West, Suite 490
Houston, Tex. 77008
(713) 880-2705

MacLink Plus

\$195

See Word Processing Utilities
for address.

Graphics Utilities

Mac-Wind

Public domain software
2242 W. Farwell
Chicago, Ill. 60645

The Graphics Link

\$99.95
PC Quik-Art, Inc.
394 S. Milledge Ave. Suite 252
Athens, Ga. 30606
(800) 523-1796
(404) 543-1779

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\$495
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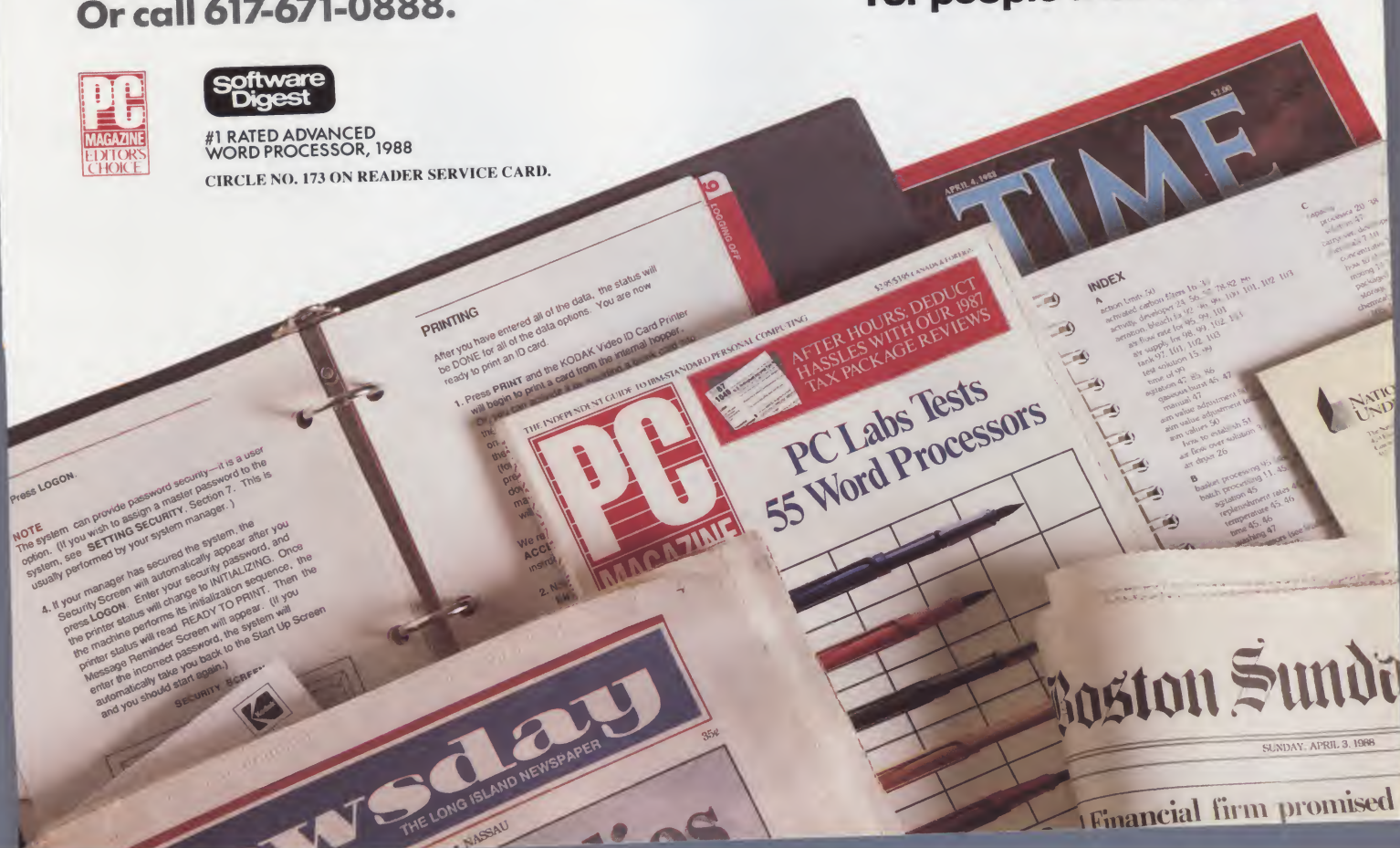
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- Extensive layering features
- Full zoom, pan and rotate capabilities
- And many other features

In addition, DesignCAD's extensive file transfer utilities allow you to read and write different formats. DesignCAD allows you to: transfer documents to and from IGES, DXF, HPGL, transfer to GEM and Postscript, and to read ASCII text files and X,Y Coordinate files.

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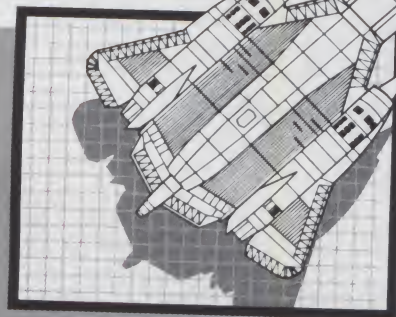
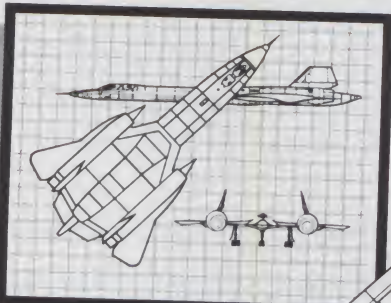
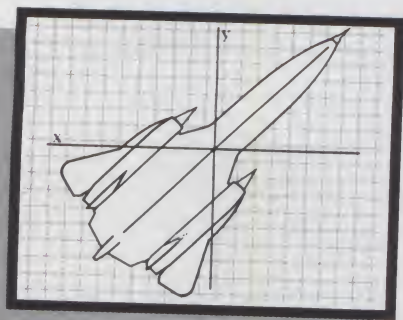
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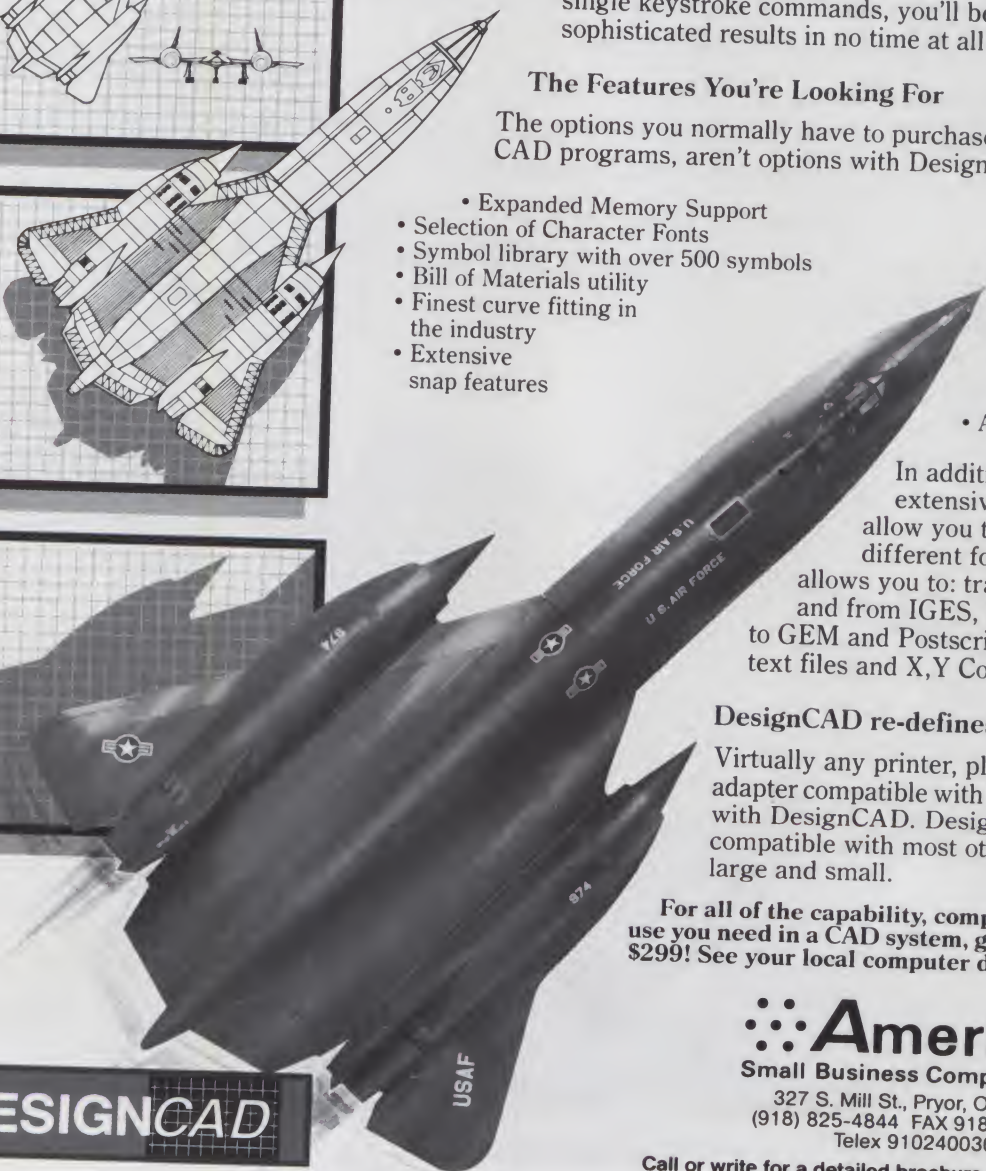
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DESIGNCAD



translation, you'll have to get rid of the line feeds and the spaces at the beginning of each record. It's a laborious process, to be sure.

If working through a text editor is simply too clumsy, a program called Apple File Exchange (from Apple Computer) or a shareware program called Evolutions (from Emerald Computing Services) can help change fixed-length records to tab-delimited ones. Also, while MacLink Plus doesn't offer any database translator, it does include many formats that might be good common denominators for exchanging files.

However you go about your conversion, be forewarned that you'll get the best results with standard text and numeric data. Date fields, calculated fields, and other database particulars may not come through the translation process unscathed. How smoothly the converted files will work depends largely on the idiosyncrasies of both the source and the target programs.

Graphics

There's no getting around it: you will need a conversion program to translate graphics. As relative newcomers to the personal computer environment, graphics programs live in a world with few standards—especially in the PC camp.

This complexity is compounded by the fact that graphics can belong to one of two broad categories: bit mapped (paint) or object (draw). As you might expect, translating graphics files belonging to the same category is easier than converting from one to the other.

While Mac software developers generally have carried the burden of coming up with translation programs to meet IBM more than halfway, it is not the case with graphics. One of the simplest and most useful translators is Mac-Wind, a public domain program. It offers PC users access to huge collections of MacPaint files (known as clip art) by translating any MacPaint file into the format used by Microsoft Windows Paint.

Although Mac-Wind does an excellent job, converting even small files takes quite a while, and the resulting PC file is considerably larger than the original Macintosh file. In one case we converted a 9,447-byte Mac file into a 51,872-byte PC file; translation took 65 seconds.

If you're translating among many formats, you'll probably want a more efficient solution. The Graphics Link (from PC Quik-Art) works as a kind of Mac-Link of the image realm, translating MacPaint files into a number of PC bit-map program formats. Alas, it's useless for object graphics.

Be prepared for some distortion in the images you send from machine to machine. Bit-map graphics are formed from pixels (picture elements), individual dots on a particular screen. Transferring a picture

from a Mac's square pixels to the PC's rectangular pixels will likely change the shape of your image. This pixel discrepancy may also cause you to lose some of your file.

Few options exist for translating object graphics. One program, Kandu Software's CADmover, offers

There's no getting around it: you will need a conversion program to translate graphics. The problem is that graphics programs live in a world with few standards.

to do so for a limited number of formats. CADmover, which runs on the Macintosh, reads IGES and DXF files, MiniCAD files, and MacDraw files. It writes in those formats too, as well as in PICT and MSC/pal Model Definition files, both common formats in the computer-aided design field. Thus CADmover is a specialized application, and so may be of little help to mainstream users.

Cleaning Up

Errors in translation are inevitable. Information transferred over phone lines often picks up garbage from static on the line. Also, the differences in character sets between two incompatible machines can bring unrecognizable entries to a translated file. If only a small amount of dirt is picked up, a simple pass of manual editing may do; otherwise, look for a good cleanup utility. In any case, check data that has traveled.

The obvious way to avoid errors in very important data is to work from a data-sharing environment so that no translation is necessary. Using a PC/Mac network such as TOPS with programs that can read and write the same file formats will save a lot of headaches.

Such diplomatic arrangements between PCs and Macs are becoming commonplace. Networks are creating multiple bridges between the IBM and Apple environments; software innovations will make those bridges unnecessary someday. Of course, that doesn't help you get that Mac spreadsheet into the marketing report on your IBM PC in time for tomorrow's budget meeting. But it should tell you that you won't have to become a professional translator to do your job. ■

Adapted from the book The MS-DOS-Mac Connection, by Cynthia W. Harriman. Copyright 1988 by Cynthia Harriman. Published by Brady Books, a division of Simon & Schuster, Inc.

4 Dot Matrix Printers

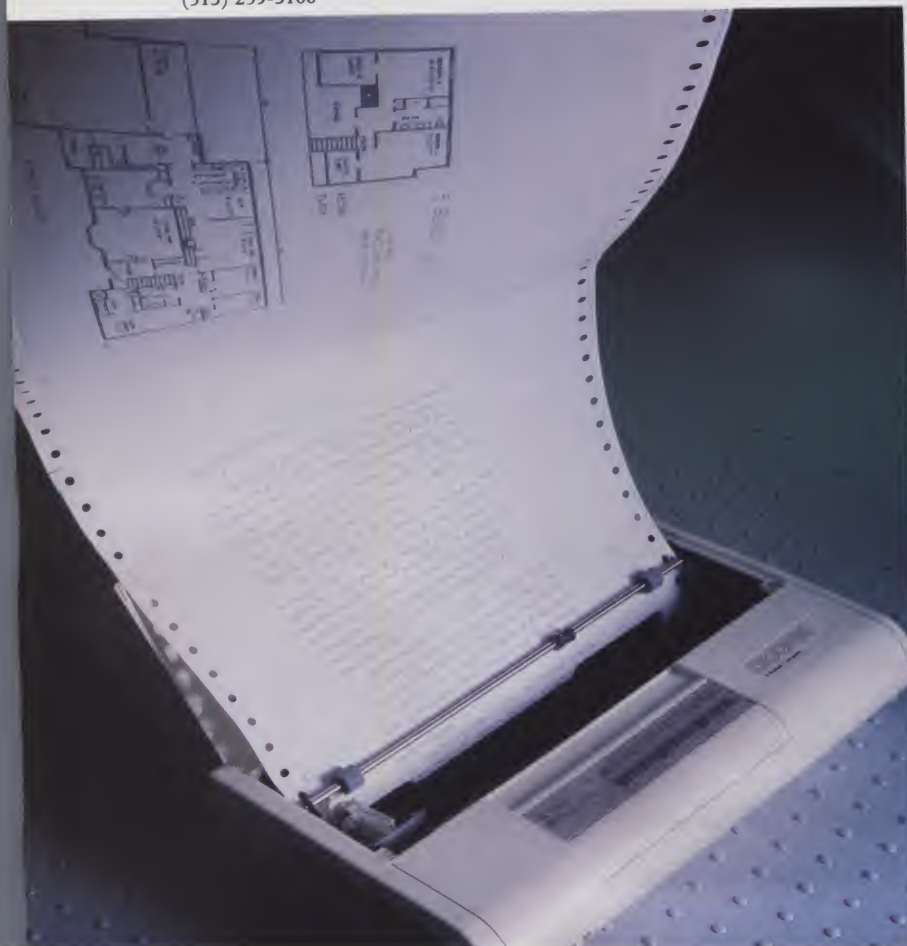
Forget the rest, these are the best: printers that stand out from the crowd. By WINN L. ROSCH

Diconix 150

List Price: \$499

In Short: A tiny but hardworking ink jet printer, the Diconix 150 operates by battery or a standard AC outlet, handles Epson and IBM graphics, and races through draft quality at up to 150 characters per second. It's the perfect companion for computing on the go.

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Ask for a high-quality dot matrix printer, and you'll probably be told you're seeking a contradiction in terms—like an honest politician or a welcome houseguest.

How can any rattletrap, eye-straining, patience-wearing mechanical beast compete with today's sleek, speedy laser printers?

But if you define high quality in terms of getting the job done, some frontrunners appear. No one dot matrix machine can claim to be best at everything, but each of the following elite quartet rates tops in real world printing. Odds are, one of them is the perfect match for your needs.

The Diconix 150 gives you hard copy not only when you want it, but where you want it—perfect for computing on the go. Panasonic's KX-P1091i pulls ahead when you want the most for your dollar—it's a budget machine that will churn out reams of top-quality text and graphics. NEC's P5300 Pinwriter offers the best print quality you'll find in an impact printer. Hewlett-Packard's Rug-gerWriter earns its laurels as an industrial-strength heavyweight.

Diconix 150

One glance at the Diconix 150 and you'll know where it fits best: anywhere. The diminutive printer handles full-size (8½-by-11-inch) cut sheets and fanfold paper with remarkable speed. Not only will it fit in your briefcase to accompany anything from an aging Radio Shack 100 to Toshiba's latest T5100 laptop, it will run on batteries or sip from the power line through its external transformer.

Despite its small stature, the Diconix 150 is no toy. Rechargeable nickel cadmium batteries are included with the machine, and it turns out good-quality printed pages. This little ink jet printer uses a combined printhead and cartridge manufactured by Hewlett-Packard. Only the adsorption of the special ink jet paper detracts from the look of its output. A more expensive cartridge (about \$13, versus \$9 for the regular model) is designed for plain-paper use.

The mechanism of the Diconix 150 is cleverly built. The print chamber cover serves triple duty: besides covering the printhead (which is securely held down by magnets), it can be raised to display single sheets as they emerge, or it can be

folded back to act as a paper separator when sprocket-fed paper is used. The five C cells for mobile power are inside the platen roller.

The sprocket-feed mechanism is a variation on the pin feed. Gripping is handled by rubberized portions of the platen, two pressure rollers, and a sprocket on the bail arm.

The printhead cartridge is good for about 500 copies (depending on how darkly you print). It snaps into place with no effort. Although installing the cartridge is a bit perplexing at first because of the scant instructions, do it once, and you'll forever be a master.

The Diconix will plug into any computer with a parallel interface. It emulates both IBM and Epson printers. Several fonts are built in, including script, compressed type, and super-/subscripts. Draft mode is commendably fast (rated at 150 characters per second), but the output is light gray. In high-quality mode, the Diconix prints more darkly, but also more slowly, requiring four passes of the printhead.

The On-Line, Line Feed, and Form Feed pushbuttons also allow you to select three principal fonts (fast, dark, and script) or start the self-test, as well as activate a number of other functions. The printers' two indicators, Power and Paper Empty, also serve a number of functions.

For printing on the go, the Diconix 150 rates as number one.

Panasonic KX-P1091i

When it comes to inexpensive, do-anything dot matrix printers, you'd expect an Epson to be the best bet. But Panasonic does Epson one better. Starting with full Epson compatibility, the Panasonic KX-P1091i adds so much in terms of convenience, simplified design, and stronger construction that there's hardly a comparison. The Panasonic works as an Epson does—it easily handles Epson graphics, which print sharply and darkly enough to satisfy the severest critic—but it's more of a joy to use and will likely last longer.

The KX-P1091i gains much of its strength from its cast-aluminum chassis bottom, which provides a sturdy foundation for its simple mechanism. The printhead is kept in line by a steel tube



and is driven by a cogged rubber belt, as is usual for printers at this level. But whereas many machines get along with all plastic gears, Panasonic adds a brass one at the point most prone to wear.

The only part of the machine that feels cheap is the cover for the printhead chamber, a removable piece of plastic that doesn't snap securely enough in place. You'll find virtually nothing in the printhead chamber because nothing is needed there—only the setup switches, safely ensconced below a clear plastic cover.

Whereas other printers use an ungainly wide-carriage ribbon, Panasonic gets along quite well with a cartridge that's about the size of an audiotape cassette. It's both easy to store and easy to load. Just snap it into place.

The KX-P1091i handles either fan-fold paper with its push-pull tractor or individual sheets with a full-width (9-inch) rubber platen. Paper feeds from and returns to the rear.

Although most dot matrix printers now add the convenience of letting you select type styles from the front panel, all too many require you to memorize strange combinations of three or four pushbuttons. Even the Diconix suffers from this shortcoming. Panasonic, how-

Panasonic KX-P1091i

List Price: \$329.95

In Short: A narrow-carriage, dot matrix impact printer, Panasonic's KX-P1091i emulates both Epson and IBM machines and delivers an optimum combination of speed, quality, and convenience at a low to moderate price.

Panasonic Industrial Co.
Office Automation Division
Group
2 Panasonic Way
Secaucus, N.J. 07094
(800) 222-0584

ever, has a slide switch for selecting the more popular printing modes, including draft—a quite good, typewriter-like Courier—and a deep black, proportionally spaced bold.

Of course, the KX-P1091i has the requisite trio of controls—online, form feed, and line feed. A big platen knob lets you position paper with precision. The standard interface is a plug-and-play parallel port. The power cord is permanently attached.

For the money, the KX-P1091i gives you the most. Perhaps the only improvement it needs is a catchier name.

NEC P5300

List Price: \$1,049

In Short: A truly elegant impact dot matrix printer, the Pinwriter P5300 boasts seven standard fonts (three proportionally spaced) and sharp, 24-wire quality. It's fast at graphics and sturdy in construction. Better on-paper quality would be hard to find in any impact printer.

NEC Information Systems, Inc.
Department 1610
1414 Massachusetts Ave.
Boxborough, Mass. 01719-9988
(800) 343-4418

NEC P5300

Elegance is the best reason to buy NEC's Pinwriter 5300. Not only is the machine itself tastefully designed, but it also draws a stylish line on paper, thanks to its 24-wire printhead. It gives the best-quality output of just about any dot matrix printer on the market.

The P5300 is unusually adept at putting together typewriter-like characters. Snap in a multistrike film ribbon instead of the standard nylon mesh, and you'll need a magnifying glass to tell the Pinwriter's work from that of an IBM Selectric.

In addition to quality, you get a choice of typefaces. Seven fonts are built in and may be selected simply by pressing a front-panel membrane switch. Most of the fonts allow you a further choice among four different pitches (10, 12, 15, or 20 characters per inch). Three of the Pinwriter fonts are proportionally spaced (and well supported—the manual even includes a table of individual character widths for setting up your software properly). If that's not enough choice, you can download fonts or add other factory-programmed typefaces using plug-in font cartridges.

High-speed draft mode lays down up to 250 characters per second and is quite readable. A bit lighter than the higher-quality print modes, its characters are merely wavy instead of appearing as disjointed dots.

The Pinwriter's 15 additional print-head wires really make a difference in graphics. Its paper images appear sharper, since each of the wires is finer than those on a typical nine-pin printer, and its lines have a lighter, more refined look. It's also fast: even in its highest-resolution mode, the P5300 requires only one printhead pass per line, compared with the two or four passes needed by most other dot matrix printers.

Graphics roll out of the P5300 nearly as fast as near-letter-quality text. The machine fully supports Epson's LQ-series 24-wire graphics commands.

All of this on-paper quality is packed into a sturdy, stylish, rounded wedge of a machine that looks like a streamlined daisywheel printer. It's heavy enough so you know it will last, but light enough to take the load off your printer stand. The mechanism is conventional—a cogged rubber drive belt and big rubber platen—and robust, as the turbine whine of the drive motors will attest.

A full-width machine, the P5300 handles individual and fanfold paper up to 16½ inches wide. (A narrow-carriage twin, the P5200, is also available.) Its compact ribbon cartridge rates as one of the easiest and most trouble-free to thread. About the only thing it lacks is color—but NEC sells an add-on kit with

Winn L. Rosch, author of several books about computing, is a contributing editor to PC/Computing.



Why Choose a Dot Matrix Printer?

► Nominating any dot matrix printer as tops—let alone four of them—is enough to raise the eyebrows of all those who destroyed their eyes poring over the printouts of a first-generation dot matrix machine. Such scoffers automatically brand anyone who favors dot matrix printers as aesthetically impaired. Both laser printers and daisywheels produce better output with sharper, more readable text than most dot matrix machines can hope to create. So how, they ask, can the dot makers hope to compete?

In fact, for certain purposes, dot matrix printers do the job better than both competitors.

To begin with, the bright outlook for daisywheels has faded. Presumably, some people still buy them, just as the Amish keep the buggy industry alive. But cheap lasers have consigned them to the same back rooms where love potions and other arcana left over from the Dark Ages are sold.

With lasers, the competition is more intense. Both dot matrix and laser printers are general-purpose machines, equally adept at text and graphics. That's understandable because laser printers are, in fact, dot matrix machines. While lasers use a combination of optical and photochemical technologies to produce dots, the classic dot matrix printer leans more heavily on mechanical operation.

Dot matrix offers more practical advantages than you might at first imagine. Most dot makers give you a choice of text modes to suit your application: not just different speeds and qualities—draft to near letter quality—but also typefaces that can be changed at the flick of a switch or with a software command. When it comes to printing type and graphics together, dot matrix does not mean either-or but both and easily combines the two.

Compared with daisywheels,

most dot matrix machines are fast. Even inexpensive machines dash out characters at twice the rate of the fastest PC-sized, fully-formed-character machines. Fast machines, such as the RuggedWriter, approach laser speed. Dot makers for minicomputers and mainframes even exceed it.

Most dot matrix machines are also pleasingly small. The biggest are just large enough to accommodate 14-inch paper for spreadsheets. The smallest—well, look at the Diconix 150. It's tiny enough to fit in a briefcase or lunch box. You can carry it with one hand or stow it under your pillow at night. Try either one with a laser printer, and your neck won't move for the next ten weeks. Lasers take over your desk; dot matrix machines make do with whatever space you give them.

Moreover, dot matrix machines are old, familiar friends in the high-tech world of constant newcomers. You can see the printhead dash back and forth. The steady dot matrix whine lets you know everything is OK. Not only can you see what's wrong, but you can easily take the dot matrix machine apart with a screwdriver. By contrast, opening up a laser printer is like looking inside an intercontinental ballistic missile—cams and gears mashed together with electronics and what-chamacallits. One false move, and it's a big disaster.

And dot matrix printers are cheap. You can buy the Diconix for about what you'd put down on a laser machine.

Of course, dot matrix machines have several downsides, but they're hardly insurmountable. All impact machines are noisy. Everything you'd be likely to compare with an impact printer's sound has unpleasant connotations—dental drills, jackhammers, garbage disposals. Most people find the "Whirr! Chunk! Clack!" of the laser printer

less annoying. Then again, keep in mind that the noise made by impact printers signifies their ability to make carbons and churn through multipart forms, something lasers can't do.

The great leveler, which flattens the claims of most dot makers, is final appearance. The ultimate insult to any printing device is calling it dot matrix quality.

True to name, every dot matrix character is made up of an array of little dots that, by some means known only to Gestalt psychologists, humans can recognize as letters of the alphabet. Use a standard, three-year-old dot matrix for business correspondence? It's as unthinkable as using crayon.

But dot matrix printers have come a long way since their early days. While high-speed draft modes can still be difficult to read, the correspondence and near-letter-quality modes of today's equipment are acceptably good, thanks to increased precision, more and thinner printhead wires (such as the 24 used by the NEC P5300), and better ribbons. In addition, a number of programs such as Fancy Font let even aged dotters show their finery. Several of these are even available as shareware on electronic bulletin boards.

In general, the output from these machines is good enough for business letters. Most make more appealing letters than lasers gone awry—the kind wielded by overzealous executives who try to cram half a dozen fonts, 16 type sizes, and a picture of the new baby on every page.

Dot matrix printers still make sense when you're counting your dollars and cents. They are still the most affordable and versatile way of generating hard copy. Each has its own tricks. The four honored here just do it better than the rest.

—WLR

an eight-color palette.

For elegance, top type quality, good speedy graphics, and features galore, the P5300 is the best pick you'll find.

Hewlett-Packard RuggedWriter

A true heavyweight in mass and stature, RuggedWriter is a delight mostly because of the little things that Hewlett-Packard thought to include. For instance, the RuggedWriter rolls its completed printout far enough past the platen so that you can read down to the bottom line and even tear off the last sheet printed. But it doesn't waste a page. As it begins the next print job, it rolls the top of the last page back inside the machine and starts printing exactly where it should.

Not only does the RuggedWriter handle fanfold paper with an easy-to-load push tractor, it also accepts a paper cartridge of individual sheets much as a laser printer does. Slide a cartridge full of stationery in the back of the machine, press a button, and go.

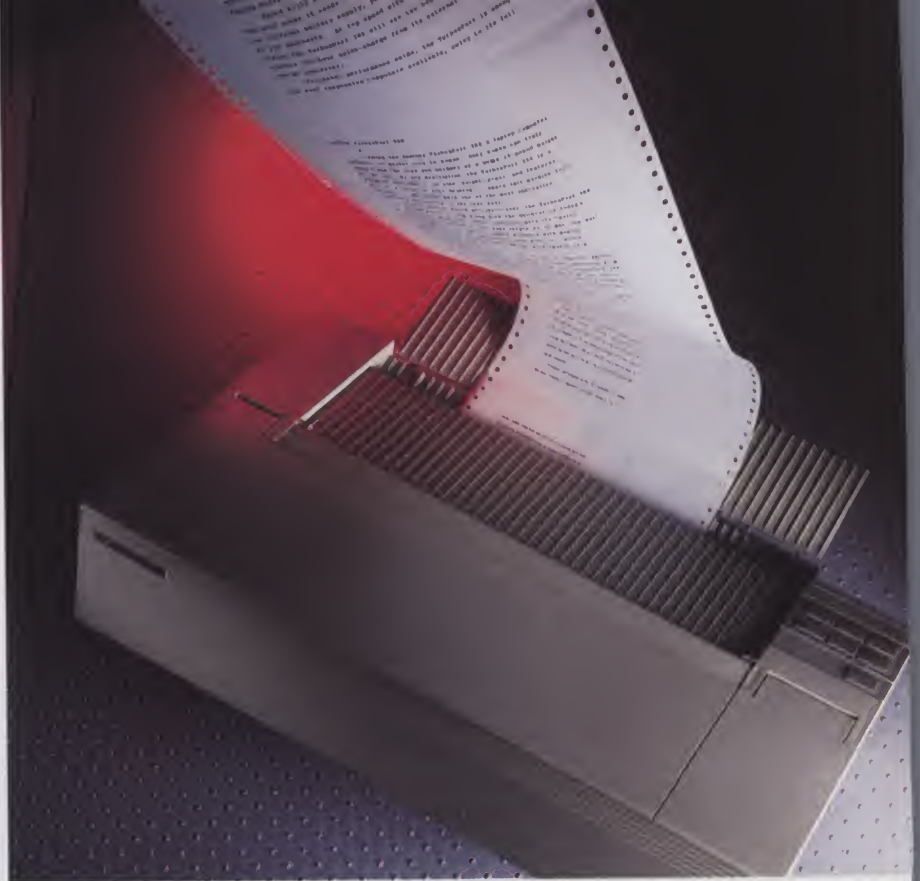
Although large—a desk-dwarfing 24 inches wide, 10 inches high, and 14 inches deep—most of that volume is covered by a stylish plastic envelope that protects the rugged mechanism that gives the machine its name.

You get access to the works by pressing latches at either side and lifting up what appears to be the entire front half of the machine, as you would with the hood of a car. Inside you'll find a rugged aluminum frame.

The printhead scans across a steel tube, driven by a long, cogged belt. The large ribbon cartridge, itself nearly 2 feet wide, bridges the entire assembly. Threading the ribbon may be the only trouble spot in the entire printer, but once that's done, normal operation should be headache-free.

Fanfold paper threads through the front. The tractors, adjustable to handle paper up to 14 inches wide, stare straight out the front once the cover is up, so you don't have to go through contortions to put paper on the proper path.

The cut sheet paper cartridge fits in the rear, and printed paper completes its journey, no matter its origin, out the top to the rear. A hinged, sound-absorbing cover opens to let you peek at the last finished sheet.



Although all functions can be controlled by software, a seven-button control panel lets you take command of the most common features on the machine itself. One allows you to choose high quality, draft, or even faster, compressed draft type. The RuggedWriter also accepts cartridges for other typefaces.

For graphics printing, the RuggedWriter allows two compatibilities, one with its own set of commands and another that understands Epson instructions. Using the latter, you can make it print in graphics mode just about any typeface you can imagine.

Both parallel and serial inputs are standard, and the Hewlett-Packard Interface Bus (HP-IB) is optional. Although a bank of dip switches confuses the installation somewhat, HP has documented the machine well. Specific instructions on making the RuggedWriter work with the IBM PC are included.

Overall, the RuggedWriter is quick, particularly in graphics mode. Although at \$1,695 it's at the top of the dot matrix range, the RuggedWriter gives you top convenience, fast output, and nice styling at a price that matches its performance. ■

Hewlett-Packard RuggedWriter

List Price: \$1,695

In Short: At the top end of the impact dot matrix printer lineup for PCs, the Hewlett-Packard RuggedWriter ranks as one of the sturdiest, easiest-to-use machines on the market. It delivers top-quality text and Epson-compatible graphics at high speed, with a host of convenience features.

Hewlett-Packard Co.
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(800) 752-0900

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CIRCLE NO. 207 ON READER SERVICE CARD.

WORDSTAR

Goes Professional

The new release of the old standby means that WordStar users can stop apologizing.

By STEVE DITLEA

FOR SEVERAL MILLION WordStar users—including myself, a veteran since 1981—MicroPro International's latest release means not having to say you're sorry. You no longer have to feel inferior to colleagues and friends who use other word processing programs that have improved over time while your venerable WordStar lagged behind. The first program that proved you could do serious word processing on personal computers finally includes features long standard in rival packages.

WordStar Professional Release 5 gives you automatic paragraph realignment during editing (no more constant Ctrl-B realign commands); split-screen display of two documents (no more groping for text in another file); rapid text sorting (no more tedious line-by-line repositioning); snaking newspaper-style text columns (no more trial-and-error column block moves); automatically compiled footnotes (no more manually juggled reference characters); easily invoked line and paragraph numbers (ditto); and true proportional spacing (at last).

In one important respect, WordStar Professional Release 5 leads the field: it boasts the first print preview function in an MS-DOS word processor to show accurately sized onscreen fonts (up to 255 per printer), true what-you-see-is-what-you-get text attributes (color, too), and formatting (with exact line and page breaks).

Another eye-opener is the preview feature's ability to display numerous miniature formatted pages at the same time—10 pages with a CGA graphics card, 18 pages with EGA, or 32 pages with VGA. And it's fast: a page is drawn and displayed on an AT-compatible computer in the blink of an eye after the preview command is invoked.

Advanced Page Preview—MicroPro's name for this feature—requires graphics capability and a 512K complement of RAM. But the rest of the functions work well on a monochrome system with a modest 384K of internal memory. And, unlike WordPerfect 5, which requires a

hard disk to function properly, the core WordStar program file and overlays fit easily on a standard 360K floppy disk.

User Friendliness

Release 5 also brings good news for new users: it foretakens the end of WordStar's reputation for being hard to learn. You can actually start using it without relying on a manual.

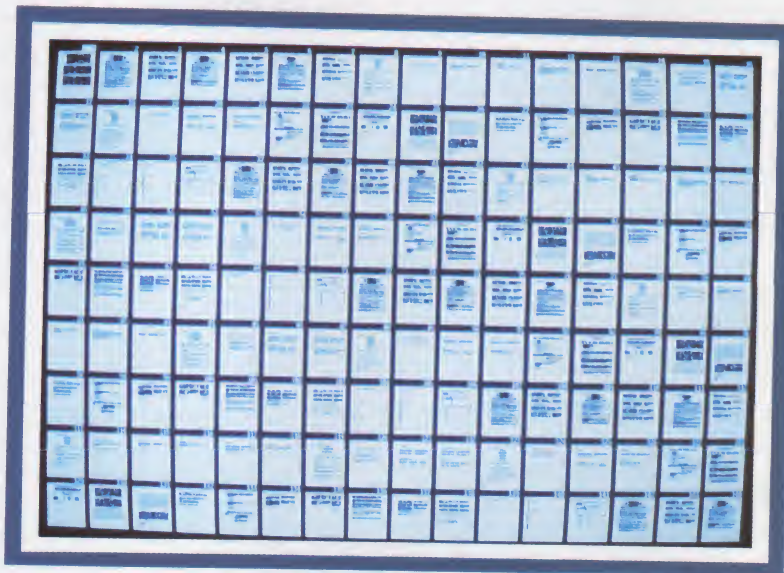
MicroPro retains WordStar's classic static menus and efficient central-keyboard-oriented command structure. Function key commands remain as options—unlike WordPerfect's finger-contorting function key combinations, many of which changed in its latest upgrade.

This version of WordStar has also added a new face. Unless reset to look like earlier incarnations, WordStar now displays an uncluttered menu bar at the top of the screen. From there, pull-down menus can be accessed by pressing Alt and the first letter of the menu, or by pressing Enter and the right or left arrow key. You can then invoke menu commands with the now familiar point-and-shoot method of moving a highlight to the proper line and pressing Enter. As with the pull-down menu interfaces in Sprint and PFS:Professional Write, function lines also list "accelerator" commands—in this case the standard WordStar letter key commands that you can type in directly.

The new Speed Write function for creating a document file without naming it first is another nice touch. From the pull-down menu interface, just press the Enter key twice and start typing. Also handy is the added ability to save a document under a new name—a useful feature for retaining different drafts.

Drawbacks

The improvements in Release 5 have taken their toll in one important respect, however. For the first time since its in-



The Advanced Page Preview mode lets you see up to 144 pages of your document on a high-resolution display system. On a system with a VGA, you can preview up to 32 pages; with an EGA, up to 18 pages.

roduction nearly ten years ago, WordStar has a new file structure that is incompatible with those of previous versions. Release 5 can read files created with earlier WordStar releases directly, but a special printer driver must translate documents created with the new program before you can use them with Release 4 or earlier editions.

For now, this inconvenience is minor, but the new file structure may prove less enduring than classic WordStar files. Its Achilles' heel could well be the 128-byte header preceding document text. All the header contains now is the name of the printer definition file with which a Release 5 file is intended to work. In later versions it may contain more vital information, whose loss could keep text from being read at all (as is the case with Microsoft Word—one of that program's great weaknesses).

For all of WordStar Release 5's strengths, it also has its share of weaknesses, many of them due to arbitrary decisions by MicroPro management. Then again, that's nothing new for WordStar, a product that has often been better than the company behind it.

A few years ago, a half-baked marketing ploy resulted in WordStar 2000, a program only an M.B.A. could love.

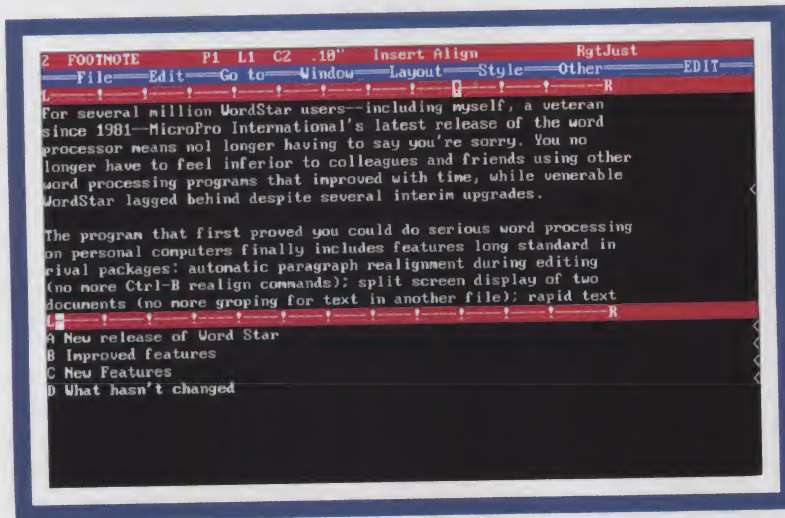
Meanwhile, MicroPro relegated the genuine WordStar (still the best-selling word processor of all time) to second-class status.

At the beginning of development for Release 5, WordStar Professional was supposed to be no better than a poor relation to WordStar 2000. But fortunately, sales of WordStar 2000's latest upgrade have been underwhelming, and WordStar Professional was allowed to surpass the performance and features of its misbegotten namesake.

Nonetheless, Release 5 was held back from realizing its full potential. For example, the program from which Advanced Page Preview is adapted—Page Setter, which is bundled with WordStar in England—shows graphics as well as text onscreen; yet this crucial feature was left out of Release 5.

Also, now that WordStar has pull-down menus, mouse support would seem to be a desirable feature. And how about access to extended memory beyond 640K for large documents? That didn't make it

PC-Outline is one of several programs and utilities that come with the new WordStar. You can run the popular outlining program in memory-resident mode, activating it by pressing Ctrl-backslash.



into the final version, either.

Better Printing Capability

On the other hand, MicroPro deserves praise for its decision to delay shipping Release 5, with all the attendant expense, until the new version's printer drivers could be completely rewritten—instead of simply repackaged from WordStar 2000. As a result, WordStar Profession-

al's printer support excels, offering custom drivers for over 100 printer models.

A hundred more printer drivers are due shortly. Included are laser printers with downloadable fonts and PostScript support. Font selection is a breeze on a menu listing font styles and sizes available for each printer. Should you decide to change printers later, the specific fonts stored in a document are automatically translated to the closest available fonts on the new printer.

True proportional spacing and the resultant onscreen formatting are facilitated by Release 5's ability to accept margin, tab, and line-height settings in hundredths of an inch. WordStar also fully supports color printers for the first time in Release 5, with another menu permitting color selection from among 16 listed hues.

Extras

At \$495, the same list price as previous WordStar editions (\$119 when upgrading from an earlier version; \$595 for a new LAN version plus \$150 per extra node), Release 5 packs an impressive array of extras that makes this word processor a better value than ever. The package contains 11 standard-sized floppy disks with program and related files—nearly double the number of disks provided with the last version of the program (3½-inch disks are also available). An improved spelling checker and a thesaurus—complete with definitions—are included. MicroPro's own Mail-List mailing management program and TelMerge telecommunications software, once offered as extra-cost options for WordStar and then omitted from Release 4, are standard with Release 5.

For those who favor outlining when creating a document, Brown Bag Software's PC-Outline is included in this package, to be run as a memory-resident program. It's activated with a Ctrl-backslash keystroke. The sleeper of the bunch of Release 5 add-ons is ProFinder, a handy DOS shell and text locator that could save users countless file-handling keystrokes.

With all the goodies in the Release 5 package, you'd think MicroPro would include utilities for converting files from and to other major word processors' file formats (as in WordStar 2000). But no, the Star Exchange program has been kept as a separate option. A simple program to restore accidentally deleted files, à la Norton Utilities, would have been useful. But you won't find it here.

Most baffling is MicroPro's ambivalence toward Inset, the graphics capture program from Inset Systems. The latest version of WordStar includes a special command for inserting Inset graphics into a document at printout, and Inset is being bundled with Release 5 for a limited time during the word processor's debut, yet there are no plans to include its graphics capability as a standard part of the WordStar Professional package. But a new version of WordStar with graphics capability is rumored to be on its way shortly.

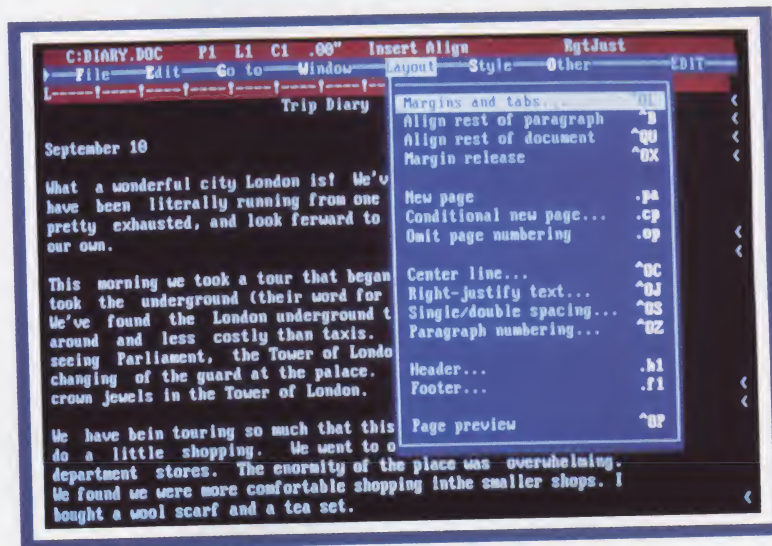
Technical Support

Untested as of this writing, but highly promising, is the new technical support policy for Release 5. At no extra cost, users will receive unlimited toll-free telephone access to MicroPro's tech experts seven days a week, for the life of the release plus six months.

As part of this generous policy, MicroPro has pledged to assign enough personnel to avoid the annoying waits typical of most companies' 800-number hot lines. If they make good on this one, the folks at MicroPro should win gratitude from a user base that has often been neglected. (Until recently, disaffected WordStar users were responsible for one in four WordPerfect purchases, lured in part by WordPerfect's reputation for superior customer support.)

Long known for being easy to customize, WordStar has several dozen new listings among the more than 250 optional settings listed on the menus of the Release 5 WSChange customization program. Useful additions include the ability to change the shape of the onscreen cursor, automatic saving to disk of an open document at set time intervals (on AT-

compatible computers), and assignment of nine separate sets of margin and tab settings for use as style-guide ruler lines for frequently used document formats. While these style guides are limited in comparison to other word processors' style sheets (in terms of spacing, align-



WordStar's new split-screen function lets you edit two documents at once, or use the second window for editing footnotes for the main document.

ment, and font settings), they are an important step toward user-defined formats for personal applications.

As for Release 5's manual, it carries on the tradition of adequate but sketchy WordStar documentation.

For those of us who would rather write than switch, Professional Release 5 is the WordStar we've long been waiting for. ▀

Steve Ditlea is the author of Using WordStar, published by the Que Corporation.

WordStar Professional Release 5

List Price: \$495 (\$119 when upgrading from an earlier version; \$595 for LAN version, \$150 per extra node).

Requires: 384K RAM; 512K RAM plus graphics capabilities to use Advanced Page Preview.

In Short: The veteran word processor finally includes features long standard in rival packages and packs an impressive array of extras. A better value than ever. MicroPro International Corp. 33 San Pablo Ave. San Rafael, Calif. 94903 (415) 499-1212

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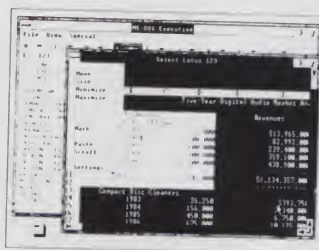
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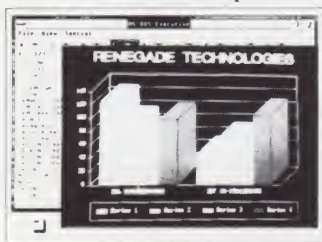
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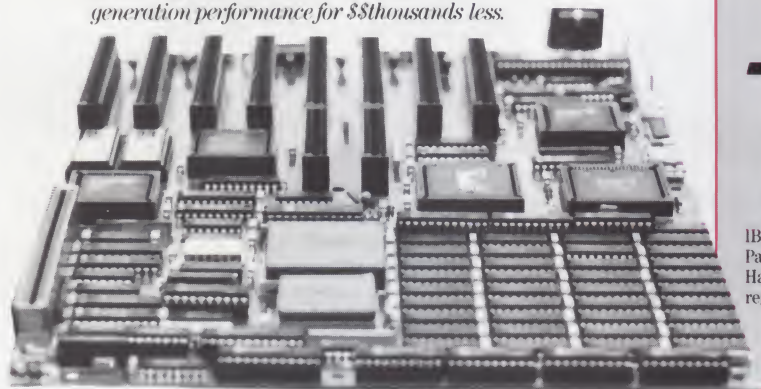
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SONY CDU-6100:

All Roads Lead to ROM

**Sony's new CD-ROM
drives pack the equivalent
of 1,500 floppies onto a
single compact disc.**

By DAVID CORNELL

I have always been something of an information junkie. Packed away somewhere I have computer magazines from 1980, old reference works, reprints, and pamphlets. They all contain information I'm saving for future use.

The frustration of trying to find any of this information is offset by the comfort of knowing it's all there.

Now there are CD-ROMs that offer the promise of not only storing massive amounts of information but also making it easy and quick to find.

CD-ROM is short for compact disc/read-only memory. It's one of the new digital optical disc technologies that is going to make *gigabyte*—that's a billion bytes—a common term in the PC lexicon. CD-ROMs use existing compact digital audiodisc technology to put 500MB of data—the equivalent of 1,500 floppies—on a single compact disc.

You have to sample a CD-ROM to appreciate fully what it means to have such a wealth of data at your fingertips. Sony recently introduced a new generation of CD-ROM drives that seems likely to become the industry standard.

The model we tested is the CDU-6100, an external drive unit. The Sony lineup also includes units with internal drives and models that can play audio under computer control. The drive units sell for under \$1,000 but are often bundled with software or databases. Up to four drives can be daisy-chained to provide access to 2.5 gigabytes of data.

These new Sony CD-ROM drives are more

compact than their predecessors. The CDU-6100 resembles a half-height 5¼-inch floppy drive with a slightly taller opening. Its single optical disc drive is packaged in a low-profile case that fits neatly under a monitor. Installation follows standard practice: A hardware interface card plugs into the PC and connects to the drive. Software drivers are loaded when the PC boots. Once installed, the CD-ROM appears to you and to DOS as an extremely high-capacity disk.

CD-ROM discs look a lot like audio compact discs, but CD-ROM discs are not inserted directly into the drive. Instead, they go into a cartridge that Sony calls a caddy. The caddy, which looks a lot like an upsized 3½-inch diskette, eliminates the complexity, bulk, and expense of the integral carrier mechanism used on full-height CD-ROM drives. It also protects discs from damage due to direct handling: once a disc is inside the caddy, you need never touch it; you insert the disc/caddy combination into the CD-ROM drive just as you would a 3½-inch disk into a computer drive.

From the user's point of view, there is little to say about the CDU-6100, which is praise of the highest order. During our test it performed flawlessly. We soon began to take it for granted—the true mark of good hardware. The only problem, if it can be called that, came when I inserted the caddy into the player without properly closing the caddy's lid. The CD-ROM disc would not move into position, and when I tried to eject it, the lid caught on the drive opening. The “solution” was



Sony CDU-6100

List Price:

Under \$1,000 (including interface card and cable).

Description:

Standalone external CD-ROM drive unit; compatible with CDU5002/CDU-100 series.

Drive Dimensions:

14 x 2 1/2 x 13 1/8 inches; 5 1/4-inch half-height drive form factor.

Disc Capacity:

540MB

Daisy Chain:

Up to four units.

Interface:

Sony 40-pin bus; SCSI available.

Audio:

Standard CD audiodisc can be played and controlled from host (not available on all models).

Data Transfer Rate:

150K per second.

Average Access Time:

.5 seconds

Sony Corporation of America
Optical Memory Group
River Oaks Pkwy.
San Jose, Calif. 95134
(408) 432-0190

to reach inside the opening and push the edge of the lid down until it snapped into place.

I used the CDU-6100 with two CD-ROM software packages, Computer Library—a joint venture of Ziff Communications and Lotus Development—and Microsoft Bookshelf. I got a glimpse of what personal computing will be like in the age of the online gigabyte, and I liked what I saw.

Microsoft Bookshelf is what it sounds like: a dictionary, a thesaurus, a zip code directory, a spelling checker, *Bartlett's Familiar Quotations*, *The World Almanac*, *Business Information Sources*,

The Chicago Manual of Style—reference works typically found on a writer's bookshelf.

Using Bookshelf is easy. A software loader and menu install as a pop-up terminate-and-stay-resident (TSR) program. Once you bring up the menu and select the reference work you need, it's loaded into memory. By hard disk standards, a long time passes before a reference work pops up. It took about ten seconds to check a spelling. For some writers a conventional dictionary would be as handy.

But don't judge Bookshelf by its spelling check-

er. When used for what it does best—searching and browsing reference works—it's miles ahead of whatever comes second.

The same can be said for Computer Library. This disc includes indexes to 43,243 computer-related articles, abstracts from 120 consumer and trade publications (full text from 10), and software to search, access, and manipulate the data. The remaining disc space is devoted to utilities and source codes from *PC Magazine* and buying guides from *PC Week*.

We were able to put Computer Library to good use during the test period. While I was familiarizing myself with the software, another editor came

Forget about your reference library: one compact disc can put all the facts at your fingertips.

by. He was working on a story about digital audio tape (DAT), and we decided to see if Computer Library could help. We put in a query to search "DAT and TAPE and STORAGE," entered exactly like that, and within 12 seconds got references to 29 articles. Each was brought to the screen in less than a second, and a single keystroke instantly brought up the next or previous page, key word, or article. A quick browse of the 29 articles turned up three that were relevant. They were copied to disk in seconds.

Those familiar with dial-up databases know just how impressive this is. Dial-up databases can take more than 12 seconds just to log on, and 10 to 15 more to fill a screen with text. Browsing back and forth through massive amounts of text isn't practical at all, and the time required to copy an article to disk is measured in minutes, not seconds. Without question, the rapid bibliographic search and retrieval made possible by CD-ROMs represents a new way to use the personal computer.

But what about the limitations of CD-ROM? Because CD-ROMs are based on audio technology, they are relatively slow by hard disk standards. Audio compact discs read data in a sequential, linear manner, whereas computers need to access data in a random manner. Any design optimized for one application is inherently less suited for the other, and that's the case with the compact disc when used in a computing environment.

How slow is a CD-ROM? Raw numbers are deceptive. The newest CD-ROM drives take .5 sec-

onds to access data. A typical PC AT-class hard disk can access data in .04 seconds—a difference of 1,250 percent. That may sound like a lot, but in practical terms it means little. The bottom line is that the slowness of a CD-ROM in some situations can be a mild irritation.

A more troubling shortcoming becomes apparent when you try to use several CD-ROMs simultaneously. We tried to use Bookshelf and Computer Library together and found that we couldn't. The memory limitations of DOS wouldn't permit it: On a 640K Compaq 286, installed with the original SideKick, drivers for the CD-ROM, and the TSR part of Bookshelf, there wasn't enough memory to run the Computer Library software. The upshot is clear: You have to configure your system specifically for what you intend to do each time you boot, or reboot and reconfigure when you switch CD-ROMs.

Such shortcomings do not diminish our enthusiasm for CD-ROM drives. We like them. Every editor who had an opportunity to try the CDU-6100 wants one. Whether *you* should want a CD-ROM drive is another question. Software creates the demand for hardware, and our enthusiasm for CD-ROMs stems largely from the fact that we used software packages ideally suited to our work.

So far, CD-ROMs have targeted specific vertical markets. They have been used to disseminate and update information previously available on dial-up database, hard copy, tape, or series of floppy disks. Lasertrak of Boulder, Colorado, for example, packages a CD-ROM drive into a 20-pound portable pilot information center. The discs contain airline flight charts, airport landing patterns, and other pilot information. Every 28 days Lasertrak distributes new ones with revisions.

Will CD-ROM software suited to more general interests become available soon? For the immediate future, development efforts will probably continue to focus on corporate markets. Affordable products for the general market may not be much in evidence. Nor is it clear what type of general-interest software will best make use of the storage capacity of CD-ROMs.

But this much is clear. The hardware, software, and major-vendor support have reached the point where CD-ROM technology is viable, available, and affordable. The speed and convenience are nothing short of spectacular, when compared with thumbing through indexes, trying to find old magazine issues, searching on a dial-up database, or taking a trip to the library. If recent history is a reliable guide, sooner or later someone will use CD-ROM technology to define a new class of software that will create a market all its own.

Maybe then I'll be able to say good-bye to all those dusty magazines and flyers. ■

David Cornell is a freelance computer writer based in Harrington Park, New Jersey.

The Cure for MacEnvy.



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Quick Fixes

How to dodge the PC repairman.

By DAVID and PERI THALENBERG

Your sleeves are rolled up, the CD player is turned on, your Darth Vader glass is full of Cherry Coke. You sit at your desk, ready to tackle a Very Important Project: to build a spreadsheet, polish up a proposal, test your new Flight Simulator scenery disk...

You turn on your PC.

Nothing happens. No lights, no video, no action.

At times like these, one question is foremost in your mind: What caused this inanimate hunk of silicon, once my trusted companion and helpmate, to turn against me?

What you should ask is: Can I fix it myself, or should I take it to a PC doctor?

As we shall see, it all depends...

The Lifeless Machine

If nothing happens when you turn on the computer, check the plugs. No kidding: Is your PC plugged in? Is it connected to a power strip or a surge suppressor, something with a separate switch? Is *that* turned on and plugged in? You might also want to check the other end of the power cord, where it plugs into the computer. Is the connection loose?

With all the plugs securely connected, try switching on your PC again. Nothing? Not even a beep or a disk drive light? Disconnect all peripherals (modem and printer, for example) and try once more.

If the computer is still dead and you have any extra boards in the expansion slots (memory expansion boards or extra ports, for example), the trouble may lie in one of them. To find out, you'll have to remove all the extra boards and see if the system works with-

out them, which means fetching a screwdriver and opening up the machine.

First make sure the computer (and anything attached to it) is unplugged. Remove the screws on the back of the machine or, in the case of the IBM PS/2, undo the catches. Then remove all the boards, except the ones to which the monitor and disk drives are attached. The monitor board is usually on the far left as you stand in front of the machine; the disk board is usually on the far right. You can double-check this rule of thumb by checking the cable connections.

Pull straight up on the extra boards; don't be afraid to put a little muscle behind your tug. With the extra boards removed, close the housing (as a safety precaution), but don't put the screws back.

Plug the computer in and turn it on. If it starts up again with no trouble, one of your extra boards is the culprit.

Feeling better? Slightly giddy with relief? The next task is to discover which board has the problem. First, turn off your PC and unplug it. Then reinsert one of the boards, close up the machine, and plug in and restart your PC.

Go through these steps for each board (making sure the computer is unplugged before you insert another board) until your PC no longer starts. That will tell you which board is defective. Return any bad boards to your dealer for trade-in or repair.

If removing the boards makes no difference, what you have is a dead computer. The problem could be in the power supply, or it could be in the basic set of chips that makes up the brain of the machine. In the

latter case, you'll need to have some repair work done by a professional (more on that topic later).

Lights Are On, but Nobody's Home

Suppose some signs of life emanate from the machine? What do you do then?

If you hear even a single beep, but the light on the disk drive is out and the screen is blank, check the monitor. Does it have a power switch of its own? Turn it on and off a few times. Check the monitor plug and the connection from the monitor to the back of the computer. Are the screws tightened? It's not vital, but sometimes the plug can fall out or become dislodged. These things are all simple problems, but it's the simple things that most often go wrong.

You might also want to fiddle with the brightness and contrast knobs on the monitor. If you have another monitor available, try exchanging it with the one that's gone dark.

If the monitor checks out, the problem could be with the hard disk. Try starting the computer with your DOS disk in drive A. If nothing shows up on the screen, you may need a new monitor or a new video card. Although it doesn't happen often, the video card that sends signals to the monitor may have failed.

Messages from the Deep

Computers usually try to tell you when things start going wrong. If the computer works when you turn it on, but it doesn't work quite right—and you've checked all the cables and connections—it's time to take action. Copy your hard disk files onto floppies.

As you're copying the files, do some detective work. Try to isolate the problem by looking and listening for abnormal behavior. Are the drive lights flashing normally? Is a drive trying to access a disk that isn't there, or is it seeking information repeatedly? Listen for the power supply fan, and check for the keyboard bell when you depress a key.

With this in mind, refer to the manual. It should help you interpret what you see and hear.

And be sure to use all your resources, not just the manual. Many computers come with diagnostic software; vendors can usually supply such programs, too. So run the diagnostics, and follow the instructions they give you. If you have a PC AT or compatible, use the setup program to double-check that all the configuration data are correct.

If you don't have a diagnostic disk or a setup program to check, you'll have to interpret your comput-

er's insistent, strange sayings, otherwise known as error messages.

The most common error message is "Error reading Drive X: Abort, Retry, Fail" (older systems may display "Abort, Retry, Ignore"). If you get this message while your computer is starting up, try hitting R for Retry. If nothing improves after you do this a few times, try A for Abort.

Hit F for Fail only as a last resort. In fact, it's best not to try it at all. When you hit F under these circumstances, the computer skips over the instructions it's trying to read and goes on to the next set. Depending on what the next set says, the results of that skip could be devastating.

So unless you know exactly what instructions the computer will skip, type A for Abort or turn the machine off and call in an expert—someone with the tools to repair damaged files.



Another common malfunction message is "Non-system disk or disk error." Interpretation: the computer can't find the initial instructions (part of the disk operating system) that tell it how to start up. If you have a hard disk, try booting up with a DOS disk in drive A. If it starts from the A drive, type C: and hit Enter. (Be sure you've copied your files from the hard disk to floppies for safekeeping.)

Next, with your DOS disk still in drive A, type Sys C: and hit Enter—this should transfer the disk operating system to your hard disk again. If you don't see a difference when you restart the computer, you may need to reformat your hard disk and restore your files to it. (Remember, reformatting the hard disk will

erase your files.)

One other thing to try is swapping DOS disks. Use another DOS disk to boot up, in case a bad DOS disk was the problem. If you see "Non-system disk or disk error" on the screen no matter what disks you use, the machine needs professional help.

If only the floppy drive gives the error message, even when you use a different DOS disk, then both your DOS disks are bad (try using one borrowed from a friend or vendor), or else the drive is defective.

If the error message appears no matter which drive you try to boot up from, chances are the drive control card inside your machine is bad. In that case, it's time to take the machine in for repair.

Owners of floppy-drive-only machines can try one more thing before the trip to the repair center: clean the drives. If the computer still doesn't work, the drives are probably defective.

Repairing a floppy drive can cost as much as buying a new one. So make sure you get a time or dollar estimate before having a drive serviced.

"Keyboard error: Press F1 to continue" is another troublesome message you may see. If the computer shows no sign of recovery even after you press F1,

your keyboard is probably defective.

What can you do? First, check that the keyboard connections are plugged in tightly. If a loose connection isn't the problem, try cleaning the keyboard. Turn it upside down and shake it. Are any dust balls or stray paper clips interfering with the keys? Try vacuuming the keyboard.

If someone spilled a beer on the keyboard during the last office TGIF party, wash it. Disconnect it from the computer and run it under warm water for a few minutes. Turn it upside down, and let it dry overnight.

The Chips Are Down

Odd numbers on the screen such as "40000 (S) 201" signal that your machine's memory chips are bad. If the computer starts and stops, the cause is probably a marginal chip that overheated.

Unless you are knowledgeable, brave, and static-free, call in an expert. Otherwise you may accidentally fry one of the main chips on the circuit board with a static discharge.

You may see several other messages on your

Maintenance Dos and Don'ts

Keep your computer clean. Buy or make a keyboard cover to help keep dust, small objects, and sticky drinks out of your keyboard. Even a pillowcase or piece of fabric will do.

Unplug the computer, open the box, and blow the dust off everything about twice a year (more frequently if your workplace is especially dusty). Dust interferes with the cooling of the chips, and hot chips can burn out.

Make regular backups. Sure, backing up is a pain—but it's less painful than trying to re-create a 50-page report or six months of accounting data. Be sure to back up your hard disk before you send your PC out for repair, make any major changes to the disk, or add a new program. Machines can be restored; sweat and inspiration can't.

If you have 15MB or more of data, invest in a tape drive that continually backs up your data. Otherwise, buy a good backup program

such as Fastback Plus (\$189 from Fifth Generation Systems, Tustin, California).

Use clean electricity. Databases and spreadsheets keep a lot of information in RAM, memory that works only when the power is on. If you use a large database or spreadsheet, get an uninterruptible power supply or a disaster recovery program such as Bookmark (\$100 from Intellisoft International, Novato, California). Why take chances?

Don't zap. Static charges can be fierce. In a static-laden environment, place anti-static mats under your computer or desk. Also, before you touch your computer, touch something metal to discharge the static you pick up from walking on the carpet. A zap that merely startles you can fry your chips and your data.

Don't smoke. Good advice at any time, but especially when it comes

to computers. Smoke coats the chips, and that makes them heat up faster. Another consequence of smoke: it coats your disk drives, and dirty drives are a problem waiting to happen.

Clean/don't clean your floppy drives. The great drive-cleaning debate rages on. We advise you to clean your floppy drives with a commercial drive-cleaning kit only when your screen suddenly says "General failure error reading Drive X:". Your drives may have the equivalent of dental plaque. But don't get carried away and start brushing them every week. You could shorten the life of the drive (or maybe not—opinions differ).

Read the instructions. Read your manuals and all instructions your machine presents on the screen. Follow them. They're there to help, even if they seem to be written in a language other than your own.

—DT and PT

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screen such as "Bad or missing command.com" or the dreaded "Bad command or file name." Interpretation: your system is looking for a missing file or a problematic file that can't perform its small background tasks.

One possible solution is to put your DOS disk in drive A and type "copy a: <filename> c:". That way you'll be putting in a new, presumably good file, and your system should run normally once more.

Expert Care

Since Murphy's Law reigns, you may encounter additional problems. What do you do? Whom do you call?

First, find your original purchase receipt. Even if the warranty has expired, call your dealer first. Parts for your particular model will probably be in stock, and maintaining a good relationship with your dealer generally means better service.

If you bought your system from a mail order outfit, or if your dealer is unwilling or unable to make repairs, check around and research some companies.

Your most valuable resource will probably be the local Yellow Pages. Look under "Computers—Service and Repair." Scan the local paper for service companies' ads; call to find out what they offer.

If your machine is made by a major manufacturer, such as IBM, Apple, ITT, AT&T, Hewlett-Packard, Compaq, or Tandy, call the manufacturer's main office to find the nearest authorized service center. They have the fastest access to parts, although they may take longer to complete repairs than an independent service company would.

Do some consumer research and read the contracts carefully.

And remember, the best deal is not always the cheapest. Reliable, well-informed, courteous service can be more valuable than low-cost service.

It usually doesn't take long to fix an ailing computer. Replacing PC parts is easy, and that's what repair usually entails. In fact, the new IBM PS/2 line is designed for fast parts replacement.

If your PC breaks down, don't be afraid to try to discover and correct the problem yourself. If your efforts fail, shop around for the right help. Good luck—and may your PC remain in running order. ▣

David Thalenberg is president of Gordian Knot Services, a computer consulting company. Peri Thalenberg is a freelance writer based in New York.

PC Protection

▶ You shudder at any suggestion of opening your machine. You cringe at the thought of footing a repair bill. You suffer from separation anxiety at the possibility of being without computing power.

Maybe you should consider buying a service contract.

Although service contracts aren't practical for most small-business and home users, businesses that cannot afford two to three days of downtime should have backup equipment, an in-house person who can do repairs, or a service contract with a reliable dealer, manufacturer, third-party maintenance contractor, or local repair shop.

Service contracts can be for on-site or off-site service. The prices vary, depending on the vendor, your equipment, and the location of the nearest service center. To decide which contract is right for you, analyze your needs, then consider your budget.

If your livelihood involves daily deadlines, you'll want an on-site service contract. Although it's the most expensive alternative, on-site service means that you simply call the vendor and a repair person is dispatched to your site. Your equipment may be back in operation within hours.

If you can afford a few days of downtime, an off-site contract is one service option. Off-site contracts offer two service choices: carry-in or pickup-and-delivery. Carry-in service costs less, but you must bring in your equipment and pick it up when it's fixed. With pickup-and-delivery service, your computer will be repaired off-site, but the vendor handles the transportation.

Off-site service contracts are fine if your needs are not desperate and your pockets are not deep. But arrange for a loaner to temporarily replace your machine while it's in the shop; a loaner agreement should be written into the service contract.

Another good idea: always have a source from which to rent or borrow equipment in emergencies.

—DT and PT

Market Value:

PCs on Wall Street

"THIS ECONOMY IS little—only 150 investors," says Harry Max Markowitz, stock market expert and programming whiz. He plunks himself down in front of a computer screen to demonstrate his latest creation, a quantitative model of a miniature stock market.

The father of modern portfolio theory proves that people, not computers, caused the Crash of 1987.

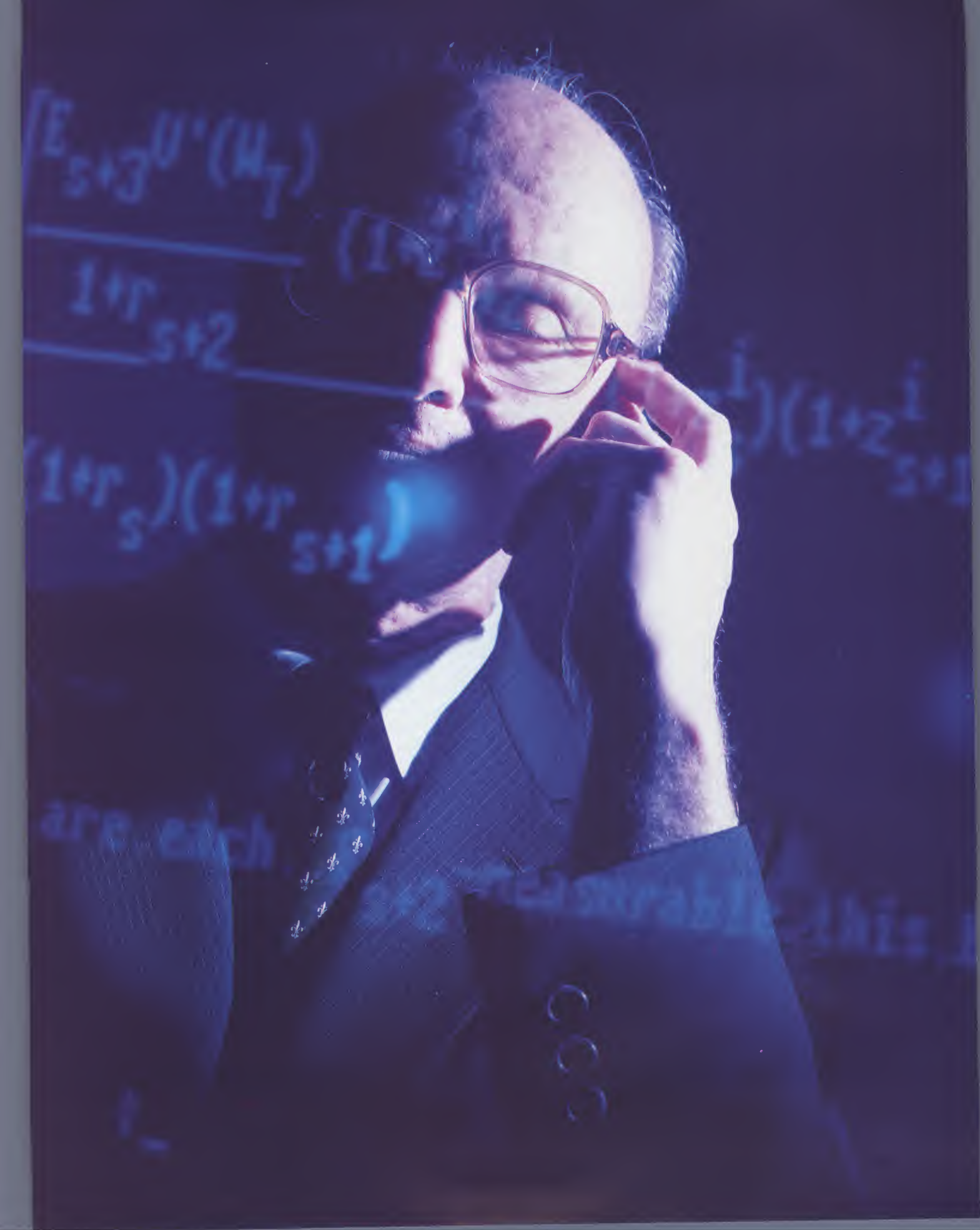
The setting: a second-floor office in Markowitz's country home, amid a library of economics and statistics tomes, a Bach fugue playing in the background. Through the windows one sees the lush forest of northern Westchester County, an hour's drive from Wall Street. Not an ivory tower, but certainly an idyllic retreat.

"The economy just has stock and cash," Markowitz explains, referring to his model. "It's very simpleminded." No bonds, no futures contracts, no money supply figures or currency exchange rates to confuse the issue.

With a simulation language that he created years ago (today used principally by the U.S. military), Markowitz has rigged up a small-scale economy on his Tandy 3000. It's like a video game with numbers instead of pictures. Markowitz is about to run it to demonstrate a fascinating theory on why the real U.S. stock market went haywire 11 months ago—and why it has been

By WILLIAM G. SHEPHERD, JR.

PHOTOGRAPH BY JAMES MCGOON



behaving strangely ever since.

Last October's stock market plunge—the titanic \$1 trillion selling panic that eclipsed the Crash of 1929 as the biggest decline of the century—almost brought Wall Street and the U.S. financial system to its knees. Was it, as many people believe, caused by computers? By computers executing arcane trading strategies based on weird mathematical formulas? By formulas born of a new breed of analysts on Wall Street known as “quants,” who ignore fundamental economic principles and instead rely on game theory and probability to analyze the market?

Indeed, a case can be made that the Crash of '87 was caused by the quants—who sometimes, to glamorize their image, call themselves “rocket scientists.” And the quants are the intellectual heirs of Markowitz, the modest, soft-spoken professor and investment theorist who 36 years ago published a seminal work that transformed the methods of quantitative financial analysis.

Insurers and Rebalancers

Harry Max Markowitz: computer scientist, father of modern portfolio theory, author of the business school classic *Portfolio Selection*, one of the brains IBM collects for its secret research labs, entrepreneur and consultant to money management firms. He is the original, the template of the abstracted academic who shows up on Wall Street speaking incomprehensible equations instead of English, whose personality seems ill-suited for the fast, hard-boiled games of trading and deal making.

Unlike most of today's rocket scientists, though, Markowitz is no kid. He is nearing 61 years of age, and the once-red highlights of his hair are now white. He maneuvers people to his left side because he can't see out of his right eye. But he still stands a strapping six-foot-two, his face is still pink and freckled, and computers bring out his boyishness. When he sits down at one, he can barely contain his glee.

“Although there are only 150 investors, you can think of them as giant pension funds, with billions of dollars each,” Markowitz says as he taps in codes to set up his model.

What is he going to do—run a computer model that shows he is to blame for the stock market's gyrations? Of course not. Instead Markowitz, an avowed foe of the strategy known as “portfolio insurance,” is going to show that portfolio insurers, rather than his progeny, are the villains of today's market.

“The investors in my model are of two kinds: rebalancers and portfolio insurers,” he explains. There are many ways to play the market, but most strategists fall into one of these two groups: those who go

with the market's trend, and those who trade against it.

Rebalancers are people who accumulate shares as prices fall and sell them off as prices rise: they trade against the trend. The term *rebalancing* refers to a popular formula of selling or buying to keep the stock portion of a portfolio at, say, 50 percent of assets. In the simplified Markowitz scheme, if prices rise so that a rebalancer's stocks account for 60 percent of his portfolio, he sells off enough shares to bring his ratio of stocks to cash back down to 50-50.

Portfolio insurers, on the other hand, use formulas that require them to buy shares as prices rise and dump them when prices fall. If the market drops, portfolio insurers sell a portion of their stock to protect the value of their holdings from falling below a predetermined level. The more the market falls, the more they sell—which of course exacerbates the de-

Trend chasers miss the beginnings of rallies and declines. Rebalancers have the opposite problem.

cline. Many investors pursue similar go-with-the-flow strategies, but Markowitz wants to make a point about portfolio insurers.

Both approaches have problems. Trend chasers miss the beginnings of rallies and declines, frequently buying high and selling low. Rebalancers have the opposite problem: They often buy and sell too early. The market keeps going down after they've bought, or it keeps rising after they've sold.

Games Investors Play

Note that neither strategy has anything to do with economic fundamentals or with the productive capacities of companies whose shares are being bought and sold. We have entered the realm of game theory.

Until Markowitz set forth his iconoclastic ideas, theoretical work had concentrated on valuing individual securities. For instance, the concept that a stock ought to be valued according to the discounted present value of its future dividends—still a common principle today—goes back to the 1930s. Markowitz was the first to quantify the relationship between risk and return. He then applied his risk/return formulas to portfolios as a whole and developed both a theory and a quantitative technique for diversifying.

Markowitz's method, which evolved from his graduate work, was first laid out in a landmark paper published in 1952 and later elaborated on in his book *Portfolio Selection* in 1959. It all started with what he

William G. Shepherd, Jr., former Wall Street editor of Business Week, writes frequently on financial topics for the New York Times and other periodicals.

calls a "random occurrence."

The son of a Chicago grocer and nephew of a prominent astronomer, Markowitz was searching for a topic for his doctoral dissertation in economics at the University of Chicago. "I was waiting to talk to my adviser," Markowitz recalls. "A broker of his was also waiting for him, and we started talking. He said, 'Why don't you look into the stock market?'"

It proved to be a fateful moment in the history of Western capitalism.

A popular book in academic circles at the time was *The Theory of Games and Economic Behavior*, published in 1944 by two Princeton professors: Hungarian-born John von Neumann, a math whiz who made major contributions to quantum mechanics and to the development of both the A-bomb and the H-bomb, and economist Oskar Morgenstern, a refugee from Silesia who believed that probability math could be used to develop winning strategies in business and warfare as well as in economics. Together they showed how the best strategies to beat a competitor in such "zero-sum" games as coin matching or chess could be applied to economics.

Von Neumann and Morgenstern had a direct influence on Markowitz. "They think of the game as a whole," he explains. "They don't have a Theory of the Black Bishop, but a Theory of Chess. So it was natural for me to think of the portfolio as a whole and to have a probabilistic view of action.

"You have to visualize: I was sitting in the library of the business school, and somehow this whole career emerged," Markowitz recalls. "I didn't see it as a whole career, but it all came together in one twinkle—that one should consider risk and return on the portfolio as a whole. By return I mean expected return. And for risk we have to pick some statistical measure. Standard deviation is the natural thing to think about for somebody who knows a little statistics."

Markowitz came up with a startling conclusion: If the stocks you choose are correlated with one another—that is, if they tend to go up and down together—you can never reduce the risk in your portfolio by more than half, no matter whether you buy 50 stocks or 500.

In other words, if you pick stocks with the greatest expected return and they happen to be correlated, in some years your portfolio will record outstanding gains, but in other years you'll get massacred. But if you pick stocks whose movements are uncorrelated, you can reduce your year-to-year risk dramatically and maximize your return over the long term. So the secret of building a good equity portfolio—one that offers the highest return for the least risk—is a lack of correlation among your stocks.

One favorite example comes from life insurance. "Let's talk about a very risky bet," Markowitz says. "I could have you put up a little money, and if you died in the coming year, I would pay your wife lots of money. But if I could get many such bets on many people—assuming that they're uncorrelated bets—then the portfolio as a whole would be a very stable one."

Simple? "It's such a simple idea, you could ask, 'What else did you do in 1952?'" Markowitz says with a laugh.

Taking Sides

Markowitz has revved up his miniature stock market and is ready to rip. "We'll let it go for 40 or 50 days," he says.

In his model, breaking news does not touch off buying or selling sprees. It's strictly an exercise in money flows and investment formulas. There is no short selling of borrowed shares with the hope of buying them back later at a lower price.

But the model does have an order-matching system like that of the New York Stock Exchange, with market makers bringing buyers and sellers together to take the two sides of stock transactions. Each investor has specific assets and objectives, is subject to random deposits and withdrawals, and periodically reviews his portfolio and buys and sells shares according to his investment strategy.

In addition, the system has margin, which enables investors to buy stocks on credit. Markowitz sets the margin at 33 percent—that is, buyers can purchase stocks by putting up only two-thirds of the total price.

"Let's try it first with all rebalancers," he says. The rebalancers' object is to keep the stock portion of their portfolios at 50 percent. Markowitz puts some at 70 percent and others at 30 percent to kick off the trading.

He hits the Enter key. The market starts out at 100. Trading begins. Numbers begin to flash down the screen. Trading days race by in seconds.

At first the market dips slightly. A week or two later it manages to rise above 100. Eventually it settles into a mild ripple, as if braiding itself around the 100 mark. The rebalancers are neutralizing each other; the trend is so stable, it's boring. How can anybody make money in a market like this?

"The only thing that keeps it vibrating at all," says Markowitz, "is the exogenous deposits and withdrawals."

Win Some, Lose Some

In the years since his landmark work, Markowitz has definitely been around the block. He put in a stint at the Rand Corporation, where he developed sparse-matrix techniques for solving thousands of simultaneous equations. In 1962 he helped found a software

firm, Consolidated Analysis Centers, Inc., to exploit his simulation language, Simscript. The movement of CACI stock after the company went public in 1969 was a market lesson in itself: it soared in the 1970s and collapsed in the 1980s.

For a while after his stint as chairman of CACI, Markowitz ran a small investment firm that specialized in arbitrage between undervalued convertibles and their related stocks. At IBM he developed a database language that ultimately was superseded by IBM's System R language.

"You win a few and lose a few," Markowitz says.

Markowitz now teaches portfolio selection at Bernard Baruch College in New York City. He is also a minority owner and research director of the Wall Street firm Brignoli Models, which manages more than \$2 billion in portfolios by computer. (Founder Richard J. Brignoli himself has a background as an atomic physicist, and Brignoli Models is truly a quant firm. "The portfolios are not touched by human hands," Brignoli says.)

Markowitz's "mean/variable, efficient frontier" approach to portfolios stimulated many other studies in the 1960s and 1970s. Building on Markowitz's work, William Sharpe and John Lintner developed what's called the capital asset pricing model, which introduced the notion of *beta*, a measure of how volatile a stock is relative to the market, and started the practice of using betas to calculate risk-adjusted returns.

By the early 1970s, other academics were using these quantitative techniques to measure the performance of portfolio management firms. The results stunned Wall Street: the vast majority of portfolio managers, it turned out, regularly underperformed

**This was no longer just
abstruse theory. Here was
something investors could use
to make *money*.**

the market—and charged fees for doing so.

Did that make sense? Of course not. Consequently, some managers introduced "index funds," which attempt to mirror the performance of market benchmarks, such as the Standard & Poor's 500. Such funds save on commissions because, rather than try to beat the market by buying and selling individual stocks (and incurring transaction fees along the way), index fund managers simply try to match market performance by plunking investors' money in a portfolio that will increase in value as stock prices rise (or decrease as prices fall).

Index, or passive, investing has become a major movement in the 1980s, channeling billions of dollars into big-capitalization stocks that most closely represent the S&P 500. That's a major reason that shares of small- and medium-sized companies, as a group, have not fared well in the 1980s bull market.

Another follow-on to Markowitz's work was developed in the 1970s by investment manager Barr Rosenberg. Considering beta too simple a model of market volatility, Rosenberg devised measures of risk relationships among different types of stocks. And economist James Tobin elaborated on Markowitz's techniques to produce a rival to John Maynard Keynes's theory of demand for money—an achievement that helped win Tobin a Nobel Prize in 1981.

The most important development for Wall Street, however, was the work of Fischer Black and Myron Scholes, who in the early 1970s adapted the capital asset pricing model to show how the price of an option should be related to the price of the underlying stock. A key factor in the Black-Scholes model was the notion that prices change continually, and that investors can trade continually.

This was no longer just abstruse theory. Here was something investors could use, in real time, to make *money*.

"The Black-Scholes model really is a giant," says Markowitz. "People would run around the Chicago Board of Options Exchange with Black-Scholes printouts. Nowadays they put Black-Scholes calculations on little hand computers and get instant values. To a certain extent, the formulas create a self-fulfilling prophecy."

And it was the Black-Scholes model that gave rise to the notion of portfolio insurance.

Options are short-term contracts that give investors the right to buy (in the case of call options) or sell (in the case of put options) stocks at a given price within a specified period of time. They are frequently used to hedge against the potential effect of a rise or drop in a stock's price. If you own shares in, say, Digital Equipment, you can achieve a measure of protection on the downside by buying Digital puts or selling Digital calls.

But many, if not most, big institutions are not permitted by their charters to trade in options. To get around that little problem, brokers that cater to institutions (banks, insurance companies, and other financial powerhouses that invest many billions of dollars at a clip) developed a theory to demonstrate that, as Markowitz explains it, "you could replicate a put by just shifting the composition of your portfolio between stocks and cash quickly enough."

That's a complicated way of saying that investors



Professor Markowitz's simulated stock market sheds light on the Crash of '87 and the havoc wrought by portfolio insurers. Markowitz is currently writing up his results to send to the SEC.

can protect themselves against stock price declines if they sell fast enough—which, of course, is exactly what they always tried to do before options came along.

It's no surprise that one of the chief proponents of portfolio insurance is Fischer Black, who was hired by one of the biggest institutional brokers, Goldman Sachs, to help devise new products and market them to institutions. Another prominent portfolio insurer is Leland, O'Brien, Rubenstein in Los Angeles.

Is that all portfolio insurance is, then—a clever marketing ploy?

"The phrase *portfolio insurance* is a wonderful marketing gimmick," Markowitz agrees. "But you have to be careful. I'm a biased observer."

Portfolio insurance can also entail selling index futures to hedge stocks. But that strategy works only

when futures contracts are trading at a premium to shares. When futures sell at a discount—as they tend to in declining markets—portfolio insurers reverse the hedge: they buy futures and sell stocks. That, of course, just sends stock prices tumbling further.

Remember, the Black-Scholes model assumes that investors can trade continually. But "that assumption broke down terribly when people actually tried to do it, in the period from October 14 to October 20," Markowitz notes.

When billions of dollars' worth of shares hit the market at the same time, specialists and buyers retreated, and prices went into free-fall. Institutional investors with multibillion-dollar portfolios used to know that they couldn't dump everything at once. Quantitative theories persuaded them that they could. Call it the liquidity delusion.

Playing the Market with Your PC

▶ Playing the stock market can be pretty risky—unless it's a computer simulation. With the growing number of Wall Street simulation programs available, it's possible for any dreamer or schemer to dabble in stocks.

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(800) 527-6263
(415) 492-3500

Requires: IBM PC or compatible, 128K; CGA or Hercules graphics adapter or equivalent.

Price: \$14.95

Because Wizard of Wall Street can be played at three skill levels, it's suitable both for novices and for professionals looking to polish their techniques. Although it doesn't offer as many stocks as most of the other market games—only 12 to 24—Wizard has plenty of data to keep investors informed, including scrolling news headlines and a constantly changing ticker tape. Players strive to increase their net worth and their wizardry over 12, 18, or 24 trading sessions, each representing a month of market activity.

Inside Trader

Cosmi
431 N. Figueroa St.
Wilmington, Calif. 90744
(213) 835-9687

Requires: IBM PC or compatible, 256K; supports all display types, including CGA, EGA, MDA, and Hercules.

Price: \$24.95

Once you know how to make honest money in the market, Inside Trader allows you to make some shady moves. Your objective, the game literature boldly states, is to "make millions of dollars without being apprehended by the Securities and Exchange Commission." Market quotations, news events, and "inside" and random information help you to plan your strategy. If you're daring and discreet, you'll make your millions. But greed or just plain foolishness could land you in jail. About the only thing missing is simulated *Wall Street Journal* headlines announcing your arrest.

Millionaire II

Britannica Software
345 Fourth St.
San Francisco, Calif. 94107
(415) 546-1866

Requires: IBM PC or compatible, 256K; Apple, 128K.

Price: \$49.95

Millionaire II challenges you to make a million—no easy task when you begin with only \$10,000 and a "novice" rating. But once the money starts rolling in, your rating rises, eventually reaching the pinnacle of broker. With this rising status come greater sophistication and the opportunity to do such things as buying on margin and borrowing from the bank. Trade decisions are based on weekly news events, price changes, and market trends—background information generated by the program.

American Investor

Britannica Software

Requires: IBM PC or compatible, 512K; two disk drives or one floppy and one hard disk drive; DOS 2.0 or later; CGA or Hercules graphics adapter.

Price: \$149.95

Britannica's Millionaire II is a game at heart, but the company's American Investor is a true simulator—and an official one at that, developed jointly with the American Stock Exchange. The program is designed for "professional and serious" investors who want to test their skills and strategies thoroughly before risking real greenbacks. Players analyze and invest in any of 47 actual companies listed in a database containing financial information over a nine-month period. American Investor also includes a comprehensive tutorial by Jeffrey B. Little, coauthor of *Understanding Wall Street*.

—Peggy Wallace

Fasten Your Seatbelts

For the second run of his little market, Markowitz turns 50 of the 150 investors into portfolio insurers. Bang: they're off.

The market jumps swiftly to 132. Suddenly it turns, and a week or so later has fallen to 85. Then—wham!—it's rallying again, back up to 137. But wait, the tide has turned again: the bulls are in retreat and the market is plunging, all the way down to 66. The numbers are bewitching as they rip down the screen.

This is wild behavior. By buying on the upswings and dumping on the downturns, the portfolio insurers have turned the market into a roller coaster ride. Think of the money to be made—if only you knew when the turns were coming. (In fact, some brokers have figured out the institutions' formulas and *do* know when the buying and selling will kick in. Trading in advance of the institutions' programs is called front-running and is considered a big problem on Wall Street.)

It's time for the model's third, and climactic, run. Markowitz resets the game for 100 portfolio insurers, two-thirds of the total players.

Since Markowitz's market is, after all, only a mock-up, it's hard to imagine fear leaping into your throat from merely watching numbers on a computer screen. But fear it is, or at least excruciating anguish: in only seven trading sessions, the market plunges to 22. That equates to about a 1,560-point collapse in the Dow Jones Industrial Average in seven days.

"Wait," Markowitz says.

The turn has begun; the market is beginning to recover. Capitalism as we know it has not been obliterated. But now, suddenly, the market shoots to 167. No, wait; it's up to 240. The rally is accelerating, to 454 . . . 967 . . . 1,400 . . .

What kind of market is this? In another week it's up to 132,000, then to 387,000, soon into the millions, until the eye can no longer follow the numbers.

What's going on? Does the market ever turn around?

No. The rebalancers are out of the game. The portfolio insurers have seized control.

"The market explodes," Markowitz says calmly. "The runaway only happens if you have margin." The margin is still set at 33 percent. In the real world, it's at 50 percent.

By making 100 of the 150 players portfolio insurers, Markowitz loaded the dice for demonstration purposes. In fact, the runaway market can sometimes occur with only 50 portfolio insurers—about once in every ten run-throughs.

"I'm in the process of writing up the results," Markowitz says. He intends to send a copy to the Securities and Exchange Commission.

Markowitz does not view portfolio insurance as an outgrowth of his own approach so much as a rival theory. Though both are based on quantitative techniques, the difference lies in how one tries to cope with risk. Portfolio insurers try to outtrade risk. The Markowitz players try to outdiversify it.

Moreover, most market swings are just that—market swings. Portfolio insurers lose a little when they try to get out, and then lose a little again when they try to get back in. Those losses are considered the cost of insurance. If the portfolio insurers stood pat, they would wind up with more money over the long term. But the brokers wouldn't make their commissions, and the money managers might, in the interim, have a bad year or quarter.

The real owners of the assets—the pension sponsors and beneficiaries—are the big losers, Markowitz believes. In the case of defined benefit plans, the los-

The market jumps swiftly to 132. Then it turns, falling all the way to 85. Then—wham!—it rallies again.

ers are a company's shareholders or the taxpayers who support public pension plans. In the case of defined contribution plans, the losers are the potential retirees.

"They're in for the long run, and portfolio insurance is not the right strategy for the long run," Markowitz says. "I thought portfolio insurance was the wrong thing to do in the first place. Then it turned out that it had extra problems. The cost increases with the volatility of the market, and portfolio insurers have made the market more volatile. Secondly, when everybody tries to collect on their 'insurance,' they can't.

"There have always been bubbles throughout history," he continues. "Whenever you have a population that wants to buy on the way up and sell on the way down, you have bubbles. Now, in addition, you have \$80 billion or \$90 billion that has been programmed to buy on the way up and sell on the way down.

"A great observation of the Brady Commission [which studied the October collapse] was that portfolio insurance calculations called for a lot more selling than they actually managed to do. If the first \$5 billion or \$6 billion hadn't swamped the market, there were many billions more behind it."

That thought is sobering. Maybe a 1,560-point drop in the Dow in seven days isn't so unimaginable after all. ■

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PCs Go Back to School

Two new PCs, at \$1,000 or less, make perfect accessories for serious (or not-so-serious) students.

By DAVID DEJEAN

Back-to-school fashion trends aren't easy to spot this fall. Stone-washed everything appears to be on the way out on college campuses, while Reeboks are still in style at junior highs. But one trend is certain: Apple's dominance in the student computer market is being challenged by a new breed of low-priced IBM-compatible PCs.

A student's PC needs are a bit different from those of a home or office user. Low price is primary, but size is important as well. Because space is limited in dorms or bedrooms, a student should have a compact system. Color and sound capabilities will help keep younger users engaged, and 3½-inch disks will stand up to rough treatment better than the 5¼-inch variety.

Two PCs that fit the bill particularly well are the Tandy 1000 HX from Radio Shack and the Dell System 100 from Dell Computer. Each of these all-in-one systems is equipped with basic hardware (with room for some expansion) and comes bundled with an integrated software package. And they're priced at \$1,000 or less.

Tandy 1000 HX

The Tandy 1000 HX has features that make it particularly appropriate for younger students—and for first-time computer buyers as well. This model is available at some 7,000 Radio Shack outlets, so help is never far away—whether from home or campus.

The compact unit is well suited to cramped quarters. The keyboard and system are combined in a case that's 14½ inches deep, 17 inches wide, and 3¼ inches high and weighs 11 pounds.

The 1000 HX has hardware features found on few other PCs. Foremost among them is the fact that MS-DOS is stored in ROM, which means that you can boot the machine even when the drives are empty. The 1000 HX is also equipped with a multivoice sound chip, a feature found in many Apple computers but uncommon in PCs. The sound chip makes the

PHOTOGRAPH BY JOHN CURTIS/HAND COLORING BY PAMELA STRAUSS

1000 HX especially well suited for entertainment and educational software such as Talking Reader Rabbit, a speech simulation program from The Learning Company.

A more sophisticated user may be turned off by some of the machine's idiosyncrasies, however. The joystick ports and earphone jack are great for games, but they don't make up for the nonstandard parallel printer connector and the lack of a serial port. Standard PC add-in cards don't fit the 1000 HX. And for typing, the keyboard's touch and feel leave something to be desired.

The \$699 version of the machine featured in the Tandy catalog is considerably underpowered, with only 256K RAM and one drive. But upgrading it is a snap, since you can easily reach the machine's card cage by removing the small plastic cover. A memory expansion adapter adds 128K of memory for \$129.95, and \$99.45 buys the additional 256K to bring the machine up to 640K.

The 1000 HX comes with a 3½-inch disk drive that holds 720K, and there's room to add another internal disk drive (\$169.95). If you want to use 5¼-inch floppy disks, you can add a 360K external drive for \$249.95. Software controls the two-speed 8088 processor.

The machine's ROM software offers inexperienced users an easy entree to Tandy's Personal DeskMate 2 software, which is included with the machine.

Personal DeskMate 2 is an integrated, window-oriented package that features word processing, spreadsheet, file management, and telecommunications programs, as well as calendar utility, a 16-color paint program that takes advantage of the 1000 HX's enhanced CGA graphics, and a music program to show off the sound chip.

Having a computer to help with writing papers doesn't mean much without a printer. Tandy offers the DMP-131 (\$399.95) with draft and near-letter-quality modes; it handles either tractor-fed paper or single sheets.

With a CM-11 color monitor (\$399.95) and a monitor stand (a \$29.95 necessity, because the system unit is too small to set the monitor on), the price of a complete 1000 HX system crests at approximately \$1,500. But if programs like Reader Rabbit are the primary focus of the user's interest, the basic machine and a monochrome monitor will come to less than \$900.

Dell System 100

The brand new Dell System 100, like the Tandy machine, is a one-piece unit with the keyboard attached to the computer case. It measures just an inch longer than the Tandy machine and is slightly heavier, at 15½ pounds. A kind of cross between the 1000 HX and an IBM PS/2 Model 30, the System 100 comes

with a monochrome VGA monitor, a 3½-inch 720K drive, and room for a second 3½-inch floppy drive or a hard drive.

The System 100 is available only by mail order from Dell Computer in Austin, Texas. Dell compensates for the absence of local retail outlets by offering extensive telephone support and extended warranties and service contracts, with service available through the national Honeywell Bull organization.

The System 100 is better suited for older students than the Tandy offering. It lacks the razzle-dazzle color and sound features available on the Tandy machine. In fact, because the System 100 comes with a monochrome display, it won't run software that requires a color graphics adapter.

But the basic machine comes much closer to the MS-DOS standard, with parallel and serial connectors and 640K of memory. It has an 8088 microprocessor that runs at three speed settings, up to a maximum of 9.54MHz. Although it's hardly a power user's dream machine—it lacks a numeric keypad, for one thing—the System 100 offers plenty of computing power for word processing and even some database or number-crunching applications. The keyboard is adequate for touch typing, and the monochrome monitor presents a crisp display.

The System 100 comes with Microsoft Works, an introductory-level integrated package that includes a word processor, spreadsheet, file manager, spell-checker, and telecommunications program. Works is a solid beginner's package with plenty of online help, easy-to-use menus, and a pleasant screen display.

Because the System 100 is more like a standard PC than the 1000 HX, it's more upgradable. Adding a card to the System 100 isn't easy—you must essentially disassemble the computer to do so. But the machine contains two standard PC card slots, which opens the door to a world of add-ins.

The System 100 is so new that final pricing has not been determined as this is being written, but Dell officials say the base system, with 64K of memory, a monochrome monitor, and one 3½-inch drive, will be in the \$1,000 range, and a model with a 20MB hard disk will be close to \$2,000.

To round out the system, Dell offers a dot matrix printer with a near-letter-quality mode for \$199.95.

Heavy-handed typists may find that the monitor image jiggles up and down just enough to be truly annoying. The obvious solution is a monitor stand. The \$29.95 stand designed for the Tandy 1000 HX works fine for the System 100 as well.

Although the base price of the System 100 is higher than that of the 1000 HX, you need fewer additional dollars to expand it. That makes the System 100 a good student PC—the objective of which, after all, is higher education, not higher finance. ■

David DeJean is a senior editor of PC/Computing.

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PC Warranties: What's the Deal?

**Lee Iacocca led
the charge, but guess
who's going to benefit?**

By JAMES POPKIN

The old joke about computer warranties was that they were good for 50 seconds or for the 50 feet it took to carry the machine from the store to the parking lot—whichever lasted longer. But, borrowing a classic promotional tool from Madison Avenue, the computer industry now offers longer warranties on parts and service in order to boost sales. No one seems to be laughing anymore.

Ever since Chrysler savior and warranty missionary Lee Iacocca began to espouse the virtues of service and buyer protection in 1981, corporate America has heeded his call. Ford and General Motors started offering warranty plans that competed with Chrysler's, and the Japanese automakers also followed suit. American companies that never would have dreamed of providing warranties suddenly made them available. Even industries with long traditions of service suddenly improved their warranty plans.

Now boneless-ham producers and self-help books tout money-back guarantees, and dishwasher and refrigerator companies battle each other over who can offer better refund programs and appliance replacement plans. It's no wonder the computer industry has changed, too.

Less than two years ago, most computer companies offered consumers modest 90-day warranties on parts and labor. But as competition grew fierce and hardware became more dependable, many manufacturers followed the lead set by Chrysler and other noncomputer firms. "Longer warranties are a trend today," says John Sullivan, vice president of marketing for Leading Edge Hardware Products, the Canton, Massachusetts, computer manufacturer. "It's definitely one of the few areas where you can separate yourself from other companies."

Today a one-year warranty on parts and labor, such as the one offered by IBM for its entire PS/2 line, has become the industry standard. Compaq also offers one-year protection on all its models introduced after 1986; the Portable II and the original Deskpro come with only 90-day warranties. Dell Computer goes IBM one better with a 30-day money-back offer, a one-year warranty on parts, and a

one-year, on-site service contract with Honeywell Bull. Last fall, Leading Edge topped them all by extending its warranty on parts and labor to 20 months. Software manufacturers, meanwhile, have continued to cover program diskettes against defects in materials and workmanship for up to 90 days from the date of purchase.

So what's new about these warranties, besides a lot of fine print? Should the length and scope of a warranty influence purchase decisions, or are the new guarantees simply more marketing mania? Just ask one Gavin Livingstone, a Berlin, Massachusetts, computer systems specialist and Example A of The Computer Buyer Who Didn't Ask Enough Questions. Livingstone thought he was saving several hundred dollars last November when he purchased a PC-compatible motherboard from his favorite repackager at a Boston-area garage that had been converted into a clone shop. He had bought a nonfunctional machine from a friend, and for \$600 the repackager installed what he was told was an honest-to-goodness Everex motherboard.

Livingstone in the past had been offered a one-year warranty on parts and service for machines he had bought from that same shop, and he assumed the motherboard carried the same coverage. He left the garage without inquiring about the exact terms.

The next day, the machine started sending strange messages indicating that the BIOS (basic input/output system) wasn't properly linked with other components. Livingstone called the shop for advice. Later, he took the case off the machine and discovered the source of his problems: a no-name Taiwanese motherboard was running the beast, not an Everex. Six months went by. Then things got really bad. The impostor clone began to whistle, beep, and demonstrate other forms of antisocial behavior. Back to the garage. As Livingstone explains, "The repackager took one look at the machine and said, 'I never told you that was an Everex motherboard. I can't warranty Taiwanese motherboards for more than six months.' Then he basically told me I was an awful customer with too many problems and he didn't want



to see me anymore.”

Livingstone's clone-buying experience was hardly typical. He learned the importance of written warranties the hard way—his replacement motherboard cost \$255. But even worst case scenarios can be useful. His advice today: “Have a unit put together by one source and have them give you a warranty.”

Software can often cause even worse problems. Remember the 1985 lawsuit brought by James A. Cummings, Inc., a general contractor, against the Lotus Development Corporation? Cummings claimed that Lotus's popular 1-2-3 spreadsheet program had malfunctioned, causing his firm to underbid a job. The case was dropped before it reached court, with Lotus insisting that operator error caused the problems.

The upshot is that computer companies cannot be held liable for economic damages beyond the purchase price of the guaranteed product. In other words, a company president whose business suffers because he uses “virus-infected” or tampered-with software will likely be compensated with only a new diskette. Although some lawyers believe that similar lawsuits will inevitably be filed, warranties, for now, are still the best protection against hardware or software failure.

Here, then, are a few more warranty tips:

- **Take advantage of the longer warranties offered by brand name manufacturers on new products.** Many older-model IBMs and Compaqs are still sitting on store shelves, but buyer beware! The older models are, of course, older, and many still come with only 90-day warranties. If it's extra protection you're after, consider buying your computer hardware or software with an American Express card. American Express will double the length of the warranty on almost any product (except automobiles) for up to one additional year.

- **Deal only with reputable mail order houses that back manufacturer warranties with their own service agreements.** Often mail order houses offer the lowest prices for computer hardware, but most brand name manufacturers consider such pur-

chases unauthorized, “gray market” buys. IBM, for instance, refuses to honor the warranty on any product not bought directly through IBM or an authorized dealer, so mail order purchases can be risky. “If you buy a gray market good and the seller goes out of business, you may be left with no warranty rights,” warns computer industry lawyer Lee Gesmer of Boston firm Lucash, Gesmer & Updegrove.

- **Buy locally, if possible.** A familiar face can help get a warranty extended a few weeks beyond the expiration date, and a seller you know will be more likely to exchange a problem computer rather than repairing it piece by piece. “I don't suggest people buy mail order clones,” says Brian Camenker, executive director of the Boston Computer Society's 16,000-member IBM PC user group. “Even if they offer warranties, they're more trouble than they're worth. I suggest people buy from local stores, and don't leave the store until the PC works. That alone will save you most of your troubles.”

Of course there are always exceptions, such as the Austin, Texas-based Dell Computer Corporation. Although Dell sells hardware primarily over the phone, its built-in, on-site service contract eliminates many potential hazards associated with servicing mail order computers. The golden rule when buying out of state is to know your seller. Local computer societies are often a good resource for learning about the reputations of discount dealers.

- **Choose a warranty that suits your computer needs.** If you expect to leave your computer on all night, every night, or if your fingers work a keyboard with all the delicacy of a jackhammer, find the longest warranty going. If you can't afford any computer downtime, pick a warranty that will provide at-home or at-work service. Under current law, these warranty extras may be the only protection you have against a one-time catastrophic computer breakdown. And above all, choose your products carefully. ▀

James Popkin is a Washington, D.C.-based freelance writer.

TOPS the WonderLAN

**TOPS lets PCs and Macs
juggle files with the greatest of
ease, at the least expense.
By JIM RODGERS**

LOCAL AREA networks are hard to install, right? And tricky to use. And expensive. And you'd better buy the right kind of network for the make of personal computer you have, because mixing different PCs on the same network is either difficult or impossible.

One LAN system gives the lie to these assumptions, by making it fast, easy, and cheap to connect IBM PCs and compatibles running under MS-DOS, Apple Macintoshes running under Apple's System-Finder duo, and even Sun workstations running under Unix. The resulting system is highly satisfactory in areas that really count for small- to medium-sized businesses—simplicity, reliability, transparency, and ease of use—though it requires substantial compromises in the speed of transfers.

That LAN—the “VolksLAN,” as some have tagged it—is TOPS, developed by Centram Systems, now a part of Sun Microsystems.

If you've got more than one computer in your home or office, you probably find yourself toting floppies from machine to machine. That kind of floppy Frisbee—also known as SneakerNet—gets old

ILLUSTRATION BY ANTHONY RUSSO



fast. A LAN is a better way to provide easier access to data. Plus it lets several computers share a costly resource, like that laser printer you've had your eye on. LANs may also offer an easy, free internal electronic mail system. And a LAN—at least, the right LAN—can help overcome some of the incompatibilities of the mix-and-match machinery that seems to be the norm in most small businesses.

For many users, TOPS is the right LAN.

TOPS is called a distributed file server network, which means you don't have to dedicate one of your computers solely to running the network. Nor do you have to assign someone to be the network administrator—and thus make everyone else suffer his or her whims and absences at crucial moments.

The name TOPS is an acronym for transcendental operating system, although Centram's founders wisely decided not to play up the transcendental angle (see sidebar). No sense tagging an eminently practical and elegant product with the baggage of mysticism, they decided.

But *transcendental* is a good way to describe what

TOPS does. It transcends the differences between operating systems on various computers. That not only makes for easier installation; it also means users of those disparate computers don't have to learn about each others' systems in order to use files residing on the hard disks in each others' computers. You don't have to know PC-DOS to use files from a PC's hard disk on your Mac, for example. Once TOPS is installed and remote files are mounted, or identified to your computer, you can do everything with those files you usually do with your own files, just as if they were on a disk in your machine.

Though you're currently limited to combining Macs, PCs, and such Unix machines as Sun's scientific/technical workstations on a TOPS network, that's actually not much of a limit. And now that TOPS has become part of Sun Microsystems, the TOPS world will broaden—because Sun plans to make the network NFS compatible.

NFS stands for network file system, Sun's proposed standard for transparent file operations among computers running any disk operating systems. Ver-



sions of NFS are already in use, for example, for Vax minicomputers running the VMS operating system and for Prime superminicomputers.

Although you may not currently have plans to install a cluster of Vaxes in your office, it's nice to know that TOPS gives you the option. Certainly, the many companies that need to move files from Vaxes to Macs and PCs will be standing in line the day NFS compatibility arrives for TOPS.

Gearing Up for Networking

For Macintosh users, TOPS is primarily a software purchase. Every Mac that Apple has built includes the AppleTalk networking system—itsself codeveloped by TOPS founder Nat Goldhaber—and TOPS uses that connection. To the Mac user, TOPS software appears as a desk accessory. The TOPS-Mac software package can be installed with extraordinary ease.

You'll also need to connect a TOPS adapter to the AppleTalk connector on Macs or install a network card such as the TOPS FlashCard on PCs and Suns. And you may need some special printer interface software if you want to drive a PostScript printer, such as the Apple LaserWriter, from IBM PCs and Sun workstations running older programs that don't know about the LaserWriter.

Physically connecting the computers is easy. For example, four computers and one LaserWriter would each have a TOPS adapter plugged into their AppleTalk connectors or an AppleTalk card installed in the PCs. LocalTalk cables from Apple or standard telephone extension cables—the kind with the modular plastic plugs called RJ-11 connectors—plug into

The TOPS installation routine for PCs allows you to make files available to other users automatically.

the adapters. Those cables can run up to 1,000 feet between machines.

Once the hardware adapters and cables are connected, installing the TOPS software on a Macintosh is easy. TOPS comes with an installation program that not only puts TOPS into the little Apple menu in the upper-left corner of your Mac's screen, but also slips the needed startup files into your System folder, lets you know that you must restart your computer before TOPS takes effect, and even handles subsequent updates of TOPS for you automatically.

Jim Rodgers is a science and technology writer based in Palo Alto, California.

Installing TOPS on the PC is almost as simple. But in the DOS world, installation programs are already commonplace—largely because software installation on PCs is often so much messier than the drag-and-icon-onto-your-disk routine common on Macs. The TOPS installation routine for PCs and compatibles asks a series of questions, then modifies your Autoexec.bat and Config.sys files in accordance with your answers. It can set things up so you automatically make files available to other users on the network, and it can automatically put you into the TOPS menu when you boot up your machine, if you prefer dealing with a menu rather than typing commands at the DOS prompt.

On the PC, of course, there's also hardware installation to deal with. The AppleTalk card you'll install to run TOPS can conflict with other add-in cards in your machine. The TOPS manual outlines the potential conflicts clearly and suggests remedies, so if you encounter a problem, you'll probably find everything you need to resolve it there.

At Home on the Mac

Using TOPS on the Mac is a delight. TOPS announces its presence by turning the Mac's cursor into a spinning top. A TOPS dialog box, which allows you to copy files from one volume on the network to any other or to mount remote files so that you can access them exactly as if they were on a local drive, needs no manual. Anyone even casually familiar with the Mac will feel right at home.

TOPS on the Mac is also forgiving. If you forget to mount a remote volume before you start your application, you can call up TOPS, mount it, and proceed.

PC Snags

On the PC, things aren't quite so simple. If, for example, you forget to mount a volume before you start your application, you'll have to drop back to the DOS prompt, do your mounting, and then return to the application. Although TOPS is implemented through the terminate-and-stay-resident facility of DOS that so many pop-up programs use, TOPS itself does not pop up, spin into view, or do anything else that might help you quickly mount your remote files if you forgot to do so beforehand.

In fairness, TOPS is no worse in this regard than most other PC networks. In fact, TOPS comes with your choice of command-driven or menu-driven control, while 3Com's PC network software, for instance, makes menus an extra-cost option.

And the TOPS menus for PC users are well designed. Commands are easy to locate, and it's possible to do all that mounting and unmounting of volumes with the cursor and Enter keys.

TOPS can pose some other problems for the PC user. It takes a considerable amount of memory away

The Early Days: Making TOPS Spin

► We visited Centram's former offices in Berkeley to find out more about Nat Goldhaber, the man behind TOPS.

We knew that his parents were physicists, that he had practiced transcendental meditation and studied throughout the world with the Maharishi Mahesh Yogi, and that he had been a Pennsylvania state government official.

The picture of Goldhaber that developed when we talked to him is one of a man who will try anything. He attributes his ability to jump into new projects and learn new skills on the fly to his experiences with TM.

He ventured into microcomputer software with no previous experience, figuring there was money to be made by linking PCs with larger machines. After failing to get a small firm to develop the network for him, Goldhaber turned to his TM connections. He knew a man called Flash, who had, like himself, traveled with the Maharishi and back in the 1970s had built his own computer from an 8080 microprocessor. Goldhaber persuaded Flash to write a network operating system called The Web.

The Web embodied Goldhaber's conviction that a network should be decentralized. His concept followed the way people share information in an ad hoc, flexible manner, with no central administrator.

The Web was a marvel: a fully distributed file server, plus electronic mail, all in a little over 6K. Goldhaber figured that with such technology and a million-dollar deal with Kaypro, which was going to distribute The Web with every Kaypro 10, Centram had it made. But the Kaypro deal was thrown into litigation, and technology was rapidly



moving beyond CP/M.

Goldhaber and Flash met with Steve Levinger at Tandy. But Tandy's interests lay in linking its line of microcomputers running five different operating systems. Although no deal materialized, Levinger set Centram's course. In late 1983 Goldhaber and Flash set out to link multiple operating systems.

At the same time Goldhaber tried to sell the network. He set up a series of meetings with Hewlett-Packard. Not until Goldhaber met with the HP VPs for the sixth time did they tell him, "We can't really do anything with you because your product doesn't exist yet."

Nevertheless, something came out of those meetings: the suggestion that Goldhaber take a look at the new computer from Apple, the Macintosh. The Mac had built-in network hardware, but no network software.

Goldhaber went to Apple to pick up the AppleTalk specifications and talk to the Apple evangelists. But no deal—until Apple's Ken Soto saw the networking software (now called TOPS, for transcendental operating system) running on a PC and a Mac at the 1984 Comdex.

On a 15-foot table in one of the dozens of Apple conference rooms, Goldhaber and Flash showed what

they could do: essentially, type "Hello" on the PC and make it appear on the Mac.

Then Goldhaber showed the demo to Steve Jobs. Goldhaber waited. Jobs scowled.

"This is just Maze Wars," Jobs pronounced, referring to a multiple-player game Apple programmer Bert Sloane had put together. With that, he stormed out, with John Sculley in tow.

About 15 minutes later, Jobs and Sculley came back and asked, "Can you do that again?"

When he saw TOPS in action again, Jobs smiled and said, "Wow, that's really far out."

The following week Jobs asked Goldhaber how much he wanted for Centram and TOPS. The deal never went anywhere. Instead, they verbally agreed that Centram would develop Apple's network operating system. When Steve Jobs was ousted and Apple reorganized, the deal evaporated.

Apple's pullout didn't topple the dream, though. Venture capitalists were interested. David Cole, former head of Ashton-Tate, and his partner, legendary lawyer Miles Gilburne (who put together many of the computer industry's big deals, including the ones that sold Framework to Ashton-Tate and Hal to Lotus), invested in Centram and TOPS. The Cole-Gilburne fund recouped its investment many times over when Centram was sold to Sun Microsystems. Now Goldhaber himself is a venture capitalist with the Cole-Gilburne fund.

Looking back, Goldhaber says TOPS eventually found success because, like PCs, it's democratic, allowing people to share resources freely and transcending the need for a technical autocrat. Actually, TOPS is what PCs are all about: personal autonomy and creativity—like Nat Goldhaber.

—Kevin Strehlo



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from other applications—so much, for example, that you shouldn't plan to run a program such as Aldus's PageMaker along with the TOPS network software. The PC PageMaker 3.0 manual warns that performance suffers when you have less than 550K of memory for Windows and PageMaker to share.

That's no joke. With TOPS active, PageMaker creeps along. That means, of course, that if you're doing something silly like bringing in Illustrator 88 graphics files from the Mac for placement in a PC PageMaker publication, you'll have to shut down PageMaker, copy the file across the network to a local PC disk, and then restart PC PageMaker. It's better to use a DaynaFile, an external add-on floppy disk drive unit for Macs that allows them to read IBM PC files; or one of several hardware and software combinations, such as MacLink, that carry files from Mac to PC via RS-232 connections.

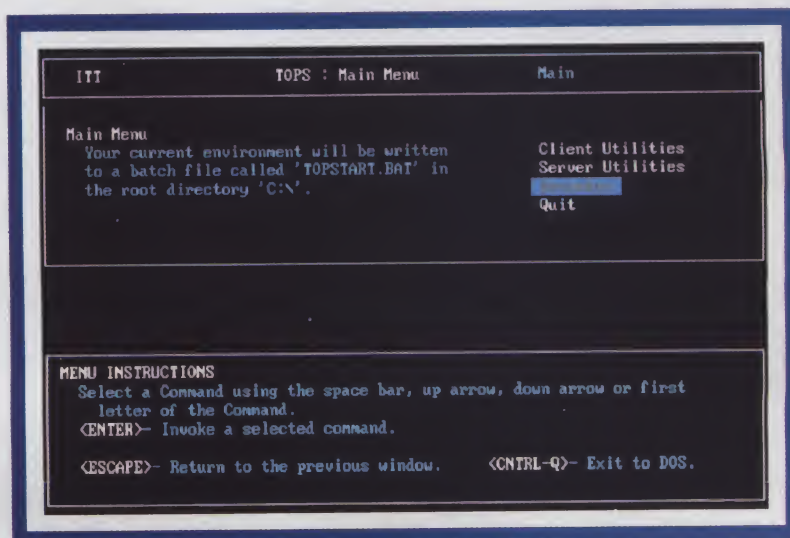
In most cases, if you follow the more normal route of writing on the PC (a great word processing computer) and handling desktop publishing on the Mac (a great graphics computer) you'll be able to work without missing a beat. Assuming you have 640K installed in your PC, you'll have plenty of memory for TOPS, your favorite RAM-resident utilities, and the word processor of your choice.

Translation Problems

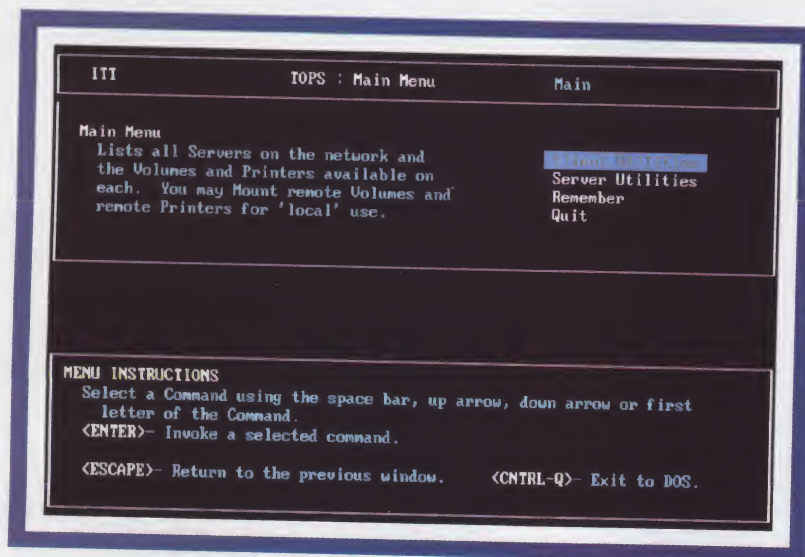
Because TOPS crosses the Mac-PC boundary, many TOPS users will need to translate files. (For more

information on sharing files between PCs and Macs, see "On Speaking Terms: PC-Mac Connectivity," by Cynthia Harriman, in this issue.) In many cases, the application software will handle that translation automatically.

Throughout the DOS version of TOPS, you'll find menus that list both instructions and descriptions of the options. Enter, Esc, and Ctrl-Q work the same way in all menus.



If, for example, you write using the Mac version of Microsoft Word, and someone else edits your work using Word on the PC, you won't have a problem. The Mac version of Word can read and write a PC file, allowing an editor free rein over the text on the PC, including the specification of typefaces, sizes, and styles. When you later double-click on the icon of that edited file on your Macintosh, eager to see what the editor has done, Word automatically translates the file back into Mac format. (TOPS can write-protect the edited Word file as well, so you can



read it but not change it.)

Sometimes application programs can't trade files, though, and you'll need to translate them. For example, if you have an ordinary ASCII text file on the PC—perhaps some information you downloaded from MCI Mail—and want to use it on the Mac, you'll need to translate it into a Mac text file. If you don't, the end of each and every line will have a little box that you will have to remove manually. Fortunately, TOPS will handle this automatically if you simply hold down the Mac's Option key when you select the Copy command to move the file across the network to your computer.

Sometimes you need more than simple translation—which is why TOPS for the Macintosh comes with file translators. The file translation program will look familiar to anyone who has used DaynaFile or MacLink, because TOPS simply uses a modified version of the same translation package that those files use.

The translations work well. If a WordStar 3.2 file is translated into MacWrite (for use in MacWrite,

TOPS considers each computer on the network—microcomputer, minicomputer, mainframe, or file server—as a “volume.” You can list the volumes and “mount” remote ones. A mounted volume is “local”—it acts like another part of your own computer.



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Word, or any other Mac word processor, all of which can read MacWrite files), for example, the formatting will remain intact.

Sharing Printers

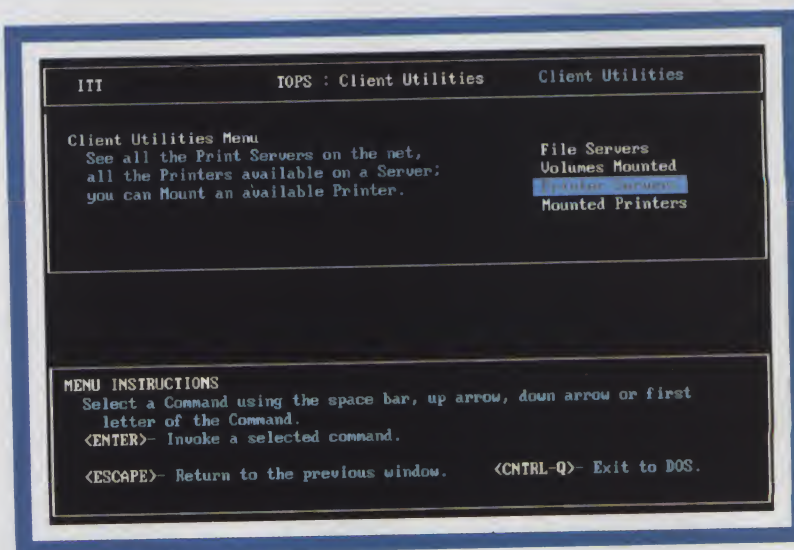
TOPS also offers a good way for network users to share a printer. If your PC software doesn't support PostScript printers, you can use its companion product, NetPrint, which will translate into PostScript format the output from any program that prints to an Epson FX-80 printer. As a result, you'll get crisp text, but the same old coarse PC graphics we've grown used to over the years. If you want the high-quality graphics made possible by PostScript, you'll have to switch to software that supports PostScript directly.

NetPrint also handles print spooling on the PC. Print spooling saves you from waiting around if there's a queue for the printer. Your file is written to disk and then automatically output later when the printer is free.

TOPSpool handles this task on the Mac, and it can be an important time-saver. Of course, the latest

Macintosh operating system, MultiFinder, includes a background printing option, which makes TOPSpool somewhat redundant. But TOPSpool works without MultiFinder, and some-

Mount a remote laser printer as "local," add NetPrint (a product for spooling and PostScript translation), and then any computer on a TOPS net can drive a PostScript printer.



times the clutter of the MultiFinder desktop is better avoided.

Although problems with TOPS on the PC are small, forgivable, and perhaps unavoidable in 640K, there are some surprising omissions. Its lack of an internal electronic mail module, for example, is especially disappointing.

If all you're doing with the program is copying files from the PC to the Mac or vice versa, such software-only products as Microsoft Mail or InBox might be better e-mail choices. All you'd do to send a file is attach it to a note and "mail" it—actually easier than the coordination required to "publish" a volume on a TOPS network—and then tell the person to whom you're trying to send the file that the what-chamacallit file is now available in that volume.

And TOPS is probably not the best choice for heavy multiuser database or accounting applications, nor for any application requiring heavy network traffic. This reflects the generally slower throughput of TOPS, which is its most important limitation. This restriction is less severe if you're running an all-PC TOPS network using TOPS FlashCards. The FlashCard can run on an AT in an enhanced mode at transmission speeds approximately three times faster than standard AppleTalk. Regular AppleTalk might *seem* adequate; 230K baud is about 200 times faster than a 1200-baud modem and slightly faster than access from a local floppy. But when you start divvying up that transmission capacity among several users, productivity plummets.

One Bay Area copy center rents time to its customers on four Macs and a LaserWriter connected by TOPS. To eliminate the trouble of checking out

software to each customer, copy center employees mount a password-protected TOPS volume for customers. At times, as many as four renters may be running application software simultaneously over the network. Things get noticeably slower under that kind of workload.

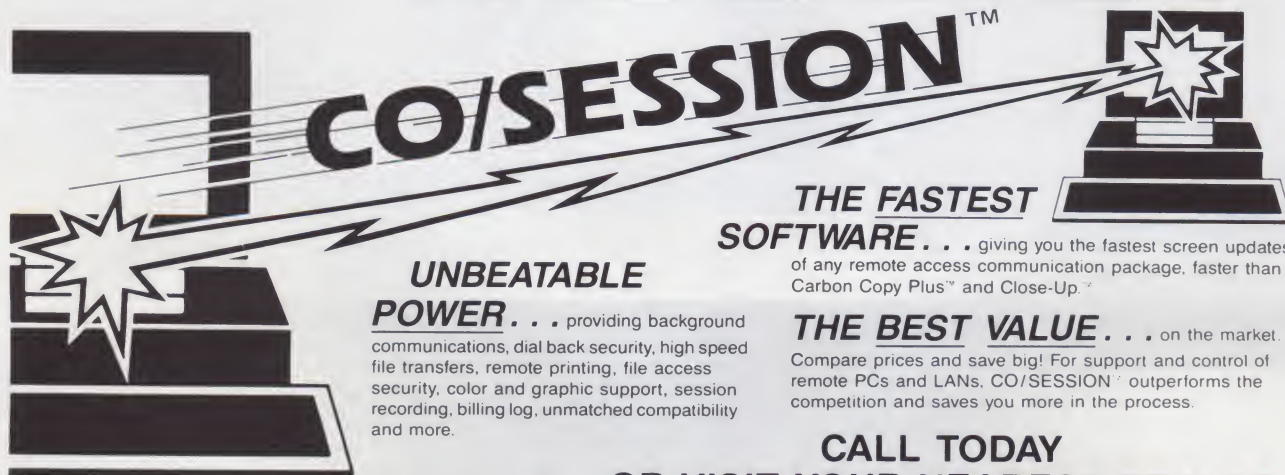
At TOPS Speed

When only one person is using the network, access through TOPS is actually slightly faster than local floppy access. But when three or four users of Word, PageMaker, and Illustrator, for example, are all clamoring for files resident on other disks across a TOPS network, the pace slows to a near crawl. It's no fun to have to wait five seconds for your Mac's pull-down menu to appear because the person next to you is rotating an encapsulated PostScript file.

It's unfortunate that TOPS has no internal electronic mail facility and that it consumes so much of an IBM PC's limited memory. But it's still very much worth a look for those more interested in simplicity, practicality, and economy than in state-of-the-art techno-wizardry.

As Centram founder Nat Goldhaber declares, TOPS can put the true power of a LAN on your desktop, instead of in a remote file server controlled by a similarly remote technocrat. ■

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Designer XyWrite

**XyWrite III Plus
is the easiest of
word processors
to customize.**

Here's how.

By STEPHEN BANKER

THE LEGENDARY A.J. Liebling used to boast that he could write better than anyone who could write faster, and faster than anyone who could write better. Lots of people are proud of their writing. A few are competitive about it. But only professionals worry about speed.

If Liebling—a larger-than-life writer whose opinionated, elegant prose appeared in the *New Yorker*—were alive today, he'd go for XyWrite III Plus. Not only is it the favorite word processor of his modern journalistic counterparts, but it addresses his concerns. The program is nicknamed "Speedy" for its rapid saves and retrieves, for its ability to flash through long documents, and for its nearly instantaneous formatting.

Liebling would be as susceptible as any of us to the love-hate relationship that often develops between writer and word processing software. When *PC Magazine*, for example, extended its Editor's Choice garland to XyWrite last January, it noted: "It's also known for

being difficult to learn. . . . The program's almost entirely command-driven structure means that becoming a proficient user requires a good deal of thumbing through the manual."

It's true that XyWrite is more standoffish than many

You can set screen colors by writing codes into your XyWrite printer driver. Here the normal mode, or MD NM, is green.

word processing programs. You have to type in commands rather than pick them from a menu. That means you must either remember them or look them up.

Blame it on the rampant machismo of the designers, a couple of superbrains who used to boss minis and mainframes around. Having come from the Atex Corporation, producers of software for hundreds of newspapers and magazines, they made sure their new product would mesh with the publishing industry.

But they didn't give much thought to making it easy. According to the "Mousemaster" (about whom more later), if XyQuest were in charge of the U.S. mail, it would design the most brilliant and innovative routings in postal history, then insist that people deliver their own letters.

Once you get past a certain intellectual aloofness, though, you can't help being impressed with XyWrite's beauty and, yes, simplicity of design. XyWrite is meant to be—and is—the ultimate word processing program for the person who can't compose a note to the babysitter without wondering how it will play in a thousand years. (Should I say, "There's ice cream in the refrigerator" or "Have some ice cream; it's in the fridge"?)

In addition to its high speed, XyWrite is proficient at footnotes, tables of contents, indexes, and more. And a few of its less-known, delightful, even quirky features are of special interest to wordsmiths.

XyWrite is the easiest of all word processors to customize. Call the keyboard, printer, or startup (configuration) file to your screen and hack away at it without ceremony, protocol, or conversion. I chose to set up XyWrite with dark letters on a light background, similar to a Macintosh display, only bigger. I also chose a steady (nonblinking) cursor. I elected not to turn on XyWrite's automatic spell-checker, with all its beeps.

I did toggle on the unusual automatic uppercase feature, which capitalizes any letter following a period, a question mark, a carriage return, and so forth. Occasionally, it's a bother (e.g., e.G.). But it's as addictive as word wrap.

Redlining is a trendy feature that allows you to change a document—to edit it—without destroying the original material, including the parts you mark for deletion. Your additions appear in a distinctive color; your deletions of the original text remain on the screen in reverse mode. That way, all your changes are tentative; you can later implement or discard them easily. Or one editor can make redlining changes, and another can review them against the original. Several other word processors offer redlining, but XyWrite's is especially well designed for writers and editors who don't want to waste time switching modes or screens.

Everybody knows about insert and overstrike;

XyWrite goes one better with word overstrike. Activate this default setting and your keystrokes will replace existing characters until you run into a space or a punctuation mark, at which point the program reverts to insert, pushing existing copy to the right.

Another convenience is truly ingenious. As a street reporter for years, I developed my own shorthand. Simple stuff: *bec* for because, *pov* for point of view, etc. Now, with XyWrite, I call a file named Pers.spl to the screen and enter my personal abbreviations, acronyms, and mnemonics—a couple of hundred of them—followed by what they stand for. There's no trick to it; you just type them in and save the file.

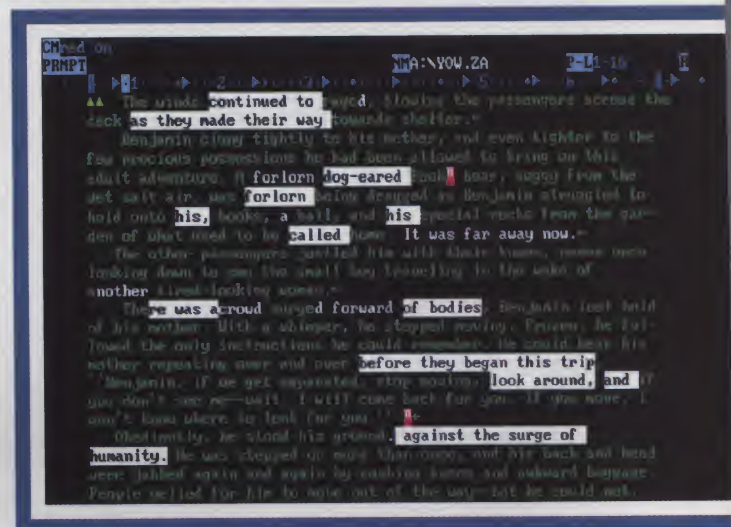
Then, for example, I type: "i shd hv bn in ny in aug." It comes out: "I should have been in New York in August." The longhand version is on the screen immediately—a real boon when I'm fighting a deadline or trying to take notes on the telephone.

Incidentally, I define the lowercase *i* as a capital letter when it has spaces on both sides, so I seldom have to use the shift key at all. In the illustration above, *I* is capitalized automatically because it starts a sentence, but it would have been capped anyway.

You don't have to learn new commands with XyWrite. All you do is tell the program the ones you're used to. And you needn't buy a package of macros for that purpose. A useful book, *XyWrite Made Easier*, includes instructions for converting to WordStar commands.

For that purpose, or anything similar, you simply call the keyboard file to the screen. It presents a picture of the keyboard with a number on each key. Paging down, you see tables for Normal, Ctrl, Alt, Shift, and so forth. Go to the appropriate table, find

Redlining shows text changes while preserving the original. Here additions are white, notes are red, and deletions are in reverse.



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A mouse lets the cursor flit about the document as quickly as a pencil point.

the number that represents the key you want to diddle with, and, using a simple system of annotation, enter the command you want your keystroke combination to execute. The instructions can be as complex and personalized as you like; for example, I've set up Ctrl-F8 to indent and italicize an entire paragraph in one stroke.

The search/change functions under XyWrite are as flexible as they are rapid. I used to shatter my less fortunate acquaintances by changing every occurrence of *the* in their files to *diddley-doo* in three seconds. Now I am more mature, so I just knock their socks off with wildcard replacement.

That tactic changes slightly different words or phrases into the same thing. For example, if I have spelled the name of Jimmy Carter's national security adviser several different ways in the course of an article, I say, "ch / Br(wildcard)ski/Brzezinski/", and XyWrite corrects my various errors all at once. This function also makes it easy to make other kinds of global changes, like making a variety of prices in a list or catalog identical.

XyWrite also provides split-screen windows—up to nine at once—for working on multiple files. One fancy feature compares adjacent files and finds where they match or differ. That undoubtedly is a godsend to programmers, though I use side-by-side windows mainly to slide quotations from my notes into articles that I'm writing.

Can't find that file you want to work on, and can't remember what you called it? The command Dirl, used just as you use Dir, shows the first few lines of every file in your directory. If that fails, XyWrite will search your disk or subdirectory for a key word.

As a bonus, XyQuest provides on request an envelope-printing program for laser printers. After writing a letter, I simply place the cursor on the address and hit Alt-N. The envelope fits snugly into the sheet feeder, and my LaserJet guides it through, printing in landscape (sideways) mode in imposing 18-point type (my brassy choice; other folks are more subtle).

All these touches are useful in themselves, but a mouse can propel XyWrite into the word processing stratosphere. With a mouse, the cursor flits about the document as quickly and smoothly as a pencil point. I use my mouse sparingly when entering text, generously during the polishing stage. That's when I do the cutting, pasting, replacing, block selection,

Stephen Banker, a former columnist for Popular Computing, also writes for Smithsonian and Science Digest.

formatting, and all the skipping about that used to be so maddeningly, agonizingly slow.

Mouse support is one of the features of an add-on called EasyXy, created in his spare time by Herbert L. Tyson III, Ph.D., a jolly, bearded economist known affectionately as the Mousemaster. The mouse in XyWrite/EasyXy is a freewheeling scamp. You don't have to click to jerk the cursor across the screen or huddle inside a bar to scroll the text; the cursor simply flows as your hand moves. Clicking is reserved, as it should be, for functions chosen by the user. The Logitech three-button device gives me seven options, among which I have selected define, delete, cut, copy, and move.

But the Mousemaster has created more than just a flying rodent. Not only does EasyXy put virtually every XyWrite command in front of you in menu form, it also adds a bunch of funny little features that nobody else handles so cleverly. For instance:

- It centers a page vertically. This improves the look of a short letter and prevents you from writing all over your letterhead.
- It capitalizes the first letters of words in a defined block, setting up titles or subheads according to certain styles.
- It makes jobs like numbering pages and printing multiple copies of the same document—which require lots of keystrokes in vanilla XyWrite—as easy as pie.

EasyXy, bless its soul, also does something called negative search, looking for instances in which part of a given string matches and part does not. This is a toy whose usefulness I haven't quite figured out. But if the need ever arises, I guess I can find all the Joneses I know who are not Joes.

It's all too easy to rave about one's favorite word processor. I have tried to maintain journalistic skepticism in the spirit of one tough reporter, Joe Liebling.

But XyWrite *is* better and faster, Mr. Liebling. And XyWrite/EasyXy with a mouse gives you the kind of behind-the-scenes power no writer should be without. ■

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XyQuest, Inc.
44 Manning Rd.
Billerica, Mass. 01821
(617) 671-0888

EasyXy

Herbert L. Tyson III
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Mt. Vernon Economics
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Alexandria, Va. 22310
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MORGAN FREEMAN

Behind the Scenes

He's already an accomplished actor. Now, with the help of his PC, Morgan Freeman may rewrite history.

By GEORGE DAMON LEVY

Forgive yourself if the name doesn't ring a bell. You might remember his face from his work on public television's "Sesame Street" or "The Electric Company." Or perhaps you caught his Obie Award-winning stage performance as the old chauffeur Hoke Coleburn in the acclaimed Broadway play *Driving Miss Daisy*. He's appeared in lots of productions, both on stage and on screen.

In Hollywood, Morgan Freeman is best known for his role as a Harlem pimp in the 1987 film *Street Smart*. The film, and Christopher Reeve's performance as a white-bread journalist who fakes a story about New York City street life, were quickly forgotten. But Freeman's performance as Fast Black, a reptile in RayBans, was one of the year's enduring images.

How good was Freeman? Good enough to impress the usually praise-stingy *New Yorker* film critic, Pauline Kael. Kael opened her review of *Street Smart* with the question "Is Morgan Freeman the greatest American actor?" Then she offered evidence that maybe he was. Of the intensity that Freeman brought to Fast Black, Kael observed, "It's like sustaining

King Lear inside of *Gidget Goes Hawaiian*."

Other critics responded similarly. New York and Los Angeles critic groups named Freeman the year's best supporting actor, as did the National Society of Film Critics. The *Street Smart* role also earned Freeman both Oscar and Golden Globe nominations.

None of which, of course, tells us much, if anything, about the *real* Morgan Freeman, the face beneath the greasepaint. Nowhere in his stage and screen roles, for example, will you find Morgan Freeman the avid yachtsman—a man who plans two years from now to sail to the tropics with his wife. He has no idea when they'll return.

Or Morgan Freeman the twenty-first century man, who uses a Macintosh 128 for his banking, his budgeting, his investment plans, even the evolving design of his dream house.

Or Morgan Freeman the student and scholar, who is using his computer to throw light on important but long-ignored events of U.S. history.

You won't find any of those Morgan Freemans on your TV or at the local Bijou.

You have to go to the man himself.

PHOTOGRAPH BY JAMES MCGOON



The Invisible Man Speaks

It's a Saturday morning in New York City, and summer is just beginning to settle in. On the streets outside Freeman's Upper West Side apartment you notice hand-lettered No Radio signs in the windows of late model BMWs and rust-tinged Toyotas alike, but don't let them throw you. By New York standards, this neighborhood is about as comfortable as they come. The streets are peaceful. You hear the breeze and the city's hum and the *scuff-scuff-scuff* of joggers making their early rounds.

Inside, next to the dining room table, in an area that doubles as an office, Morgan Freeman leans back and swivels in his chair. He looks different somehow, hardly recognizable. His hair is cropped close for a film project, but the difference is more

real success, was a long time coming.

"Shortly after I got my computer, I started to subscribe to a computer magazine. I guess buying the computer was all right. Subscribing to the magazine," he says, with gentle irony, "was a marketing error."

A marketing error?

"A person starts reading about new products—about what computers can do and where you can go from here.

"The next thing you know I was looking for an upgrade and more memory, more powerful writing tools and other programs. I got into home budgeting. Then we decided we're going to build a house, so let's get ourselves a program so that we can design it. It just goes on and on."

Freeman has three long manuscripts, all novels, stored in his Mac. He calls them "G.A." novels—short for "Great American."

than that. The Morgan Freeman we expected is nowhere in sight.

"I talked myself into getting one of these," he says, pointing to his PC, "because I do a lot of writing and I'm not a writer.

"Writing's difficult for me. I get spurts of ideas that start to blossom out and balloon, and then they peter out.

"But I thought, If I got a word processor . . ."

Freeman was born 51 years ago in Greenwood, Mississippi, the son of a man he describes as a "reformed ne'er-do-well, a hustler in the most grim definition." He went to college in Los Angeles for three semesters, then entered the military. He wanted to become an air force pilot, but his ambition was thwarted, he says, by prejudice. After leaving the service, he devoted himself to acting.

"I happened to be in Brussels one time with some friends of mine. I was supposed to write up the marriage ceremony for my wife and I. And my friend said, 'Here. Do it on this.' He had an IBM PC-XT in his office.

"So I started playing with the word processor, and, of course, it was fascinating—what you can do with a word processor as opposed to pen and paper.

"That sold me. I came home and immediately started looking into computers."

Freeman was in his twenties when he hit Hollywood. He fully expected to be a star, but he learned quickly that the path he had chosen was "a harder road than it looks." There were times, in fact, when it seemed impassable. But he kept pushing ahead, pushing ahead. He did plays. He did TV. He landed bit parts in films. Success,

George Damon Levy, formerly the editor of AutoWeek magazine, is currently at work on his first novel. This is his second article for PC/Computing.

There were times when Freeman was tempted to give up acting, but something always steered him back. In the 1960s, when he found roles scarce, he landed a job on Madison Avenue. It wasn't much, but he liked the people and they liked him. When a desk position opened up, he lobbied for it. He was crushed when it went to someone else, but realized it was his own fault. When his boss had asked, "If I give you the desk and tomorrow you get a role in a play, you'll be gone, right?" Freeman had told her the truth. The next year he was on the road.

"After a point your interest in computers doesn't have anything at all to do with need. It's . . ." He launches into a breathy monologue:

"Have you heard the latest?"

"No, what?"

"They got XYZ that can do this and this and . . ."

He laughs. His entire body relaxes. He's poking fun at himself in a manner that only someone truly at ease with himself can. He can say, "Look at me. Now what kind of fool . . ." knowing full well that he's not a fool—and that no one would mistake him for one.

"Like for instance, this CAD [computer-aided design] program. I mean, now what in the world would I ever do with one of those?

"But I want to have a computer [powerful enough] so that if I ever decide to, I can run out and get one and stuff it in my computer and it will work."

After *Street Smart*, offers began to pour in—some good, some not so good. Freeman turned down, for example, a role in *Superfly IV*. But he accepted the lead in *Lean on Me*, the story of Joe Clark, the baseball-bat-wielding New Jersey high school principal. The film, scheduled for release at the end of the year, marks Freeman's first starring role.

When we ask if being the star of a movie is all it's cracked up to be, Freeman cuts us short.

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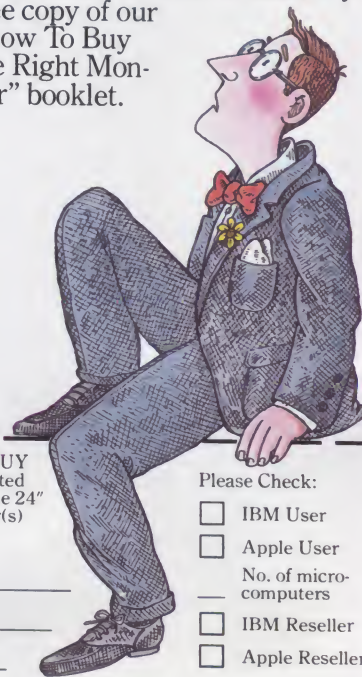


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"Being a star is great. Being a star is always great. If you can deliver."

In Pursuit of the Visible Man

They say you know a lot about a man if you know his ambitions. Ask Morgan Freeman if there's anything left he'd like to accomplish, and he won't talk to you about acting. He'll talk instead about how the achievements of black Americans have been overlooked in history books, how black Americans have been the invisible men and women of U.S. history. And then he'll tell you what he's doing about it.

"Lots of people think black people have never done anything in this country. We were slaves, and then we were free; now we're trying to burn the place down . . . Well, that's not so."

Freeman is hardly the first to cite this failure of our history texts. The invisibility he speaks of was the subject of Ralph Ellison's novel *The Invisible Man*: "I am not a spook like those who haunted Edgar Allen Poe; nor am I one of your Hollywood-movie ectoplasms. I am a man of substance, of flesh and bone, fiber and liquids—and I might even be said to possess a mind. I am invisible, understand, simply because people refuse to see me." To paraphrase Ellison, blacks have been invisible in our history textbooks simply because the historians have refused to see them.

Says Freeman: "Nobody knows, for example, that we've fought in every single—every *single*—conflict. From the Revolutionary War all the way to Grenada. But it's true.

"And many of us died, in great numbers.

"Five thousand black people fought in the Revolutionary War. But it wasn't until recently that the DAR would even deal with the fact that we belonged."

When Freeman says he bought his computer in order to help him write, what he's talking about is re-writing our history. Without a computer, and what a computer enables a writer to do, he might never realize his ambition. But now he has three long manuscripts, all novels, stored in the memory of his Mac. He calls them "G.A." novels—short for "Great American." He's also working on a story about black cowboys.

"Movies have really romanticized the West—cowboys and stuff. John Wayne has become our sort of icon of the West. It's as if black people didn't exist out there, and that's not true.

"When the early settlers started moving West, out of Missouri, out of the Missouri territories, out into Nebraska, Montana, and all that, the people who were out there to protect them were black.

"Nowhere has anyone ever dealt with that. There was one little movie called *Buffalo Soldiers*. That's it. "That's criminal to me."

Freeman would like to see his story about black

cowboys made into a movie, so that it could reach the widest audience possible. And he wouldn't mind playing a leading role.

What are the chances that the cowboy movie will actually get made? Freeman's response reveals a kind of world-weary sagacity:

"It all depends on what happens with Joe Clark."

And Then He'll Simply Vanish

Even if *Lean on Me* is a huge success—the sort of triumph that gives an actor his pick of any script in Hollywood—Freeman will have precious little time to take advantage of his stardom. Because in two years, at what may well be the high point of his career, Morgan Freeman, one of the great invisible men of our cinema and stage, intends to disappear again.

"I'm going to go sailing. Nineteen-ninety. Two years from now. When my career is peaking."

As currently planned, the trip will be open-ended. And there will be no talking him out of it. It will be just Freeman, his wife . . .

"And my computer."

That he will take a computer is a given. Which one is still open to consideration.

"I may get a laptop. I can have [the Macintosh] altered to run on 12 volts, but it'll take a lot of juice."

Freeman already envisions a compartment on the boat just for the computer. He wants it along not only as a writing tool—he's hoping to write a series of magazine articles about his travels to help to defray the cost of the journey—but as a tool that can help him to run his life.

When asked if it's good business to leave for the tropics just when his career might be switching into high gear, Freeman answers quickly. The peak, he says, is the best time to go.

"It's a lot easier to go when people are scrambling after you."

The Best Time

It's getting late. It's been several hours, and Freeman has other appointments.

Our last impression of Morgan Freeman is that he talks like someone who has lived a life of extremes, someone who has been one of the privileged and one of the unprivileged, someone who has dwelled in the spotlight and in the void.

Today Morgan Freeman is living in the spotlight. His horizons seem unlimited.

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"It's always the best time to be Morgan Freeman."



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Dale's Prayer

**He zooms, he changes parameters,
he loses track of time.**

By JOHN UPDIKE

Roger's Version, John Updike's sixteenth novel, recounts the unusual meeting of 52-year-old Roger Lambert, an assistant professor at a divinity school, and graduate student Dale Kohler, a computer whiz and fundamentalist Christian. Kohler wants to prove the existence of God by way of interdisciplinary number crunching on the college mainframe.

Kohler approaches Lambert about a grant for his project. Lambert, a disgraced Methodist minister who scandalized his congregation 14 years earlier with an affair that resulted in his remarriage, feels "aesthetically and ethically" uneasy about Kohler's project. Nevertheless, he comes up with a small stipend for the student.

Roger's Version is part theological dialogue, part exploration of American sexual angst, part computer odyssey. In this excerpt, we join Kohler as his search for God reaches a turning point.

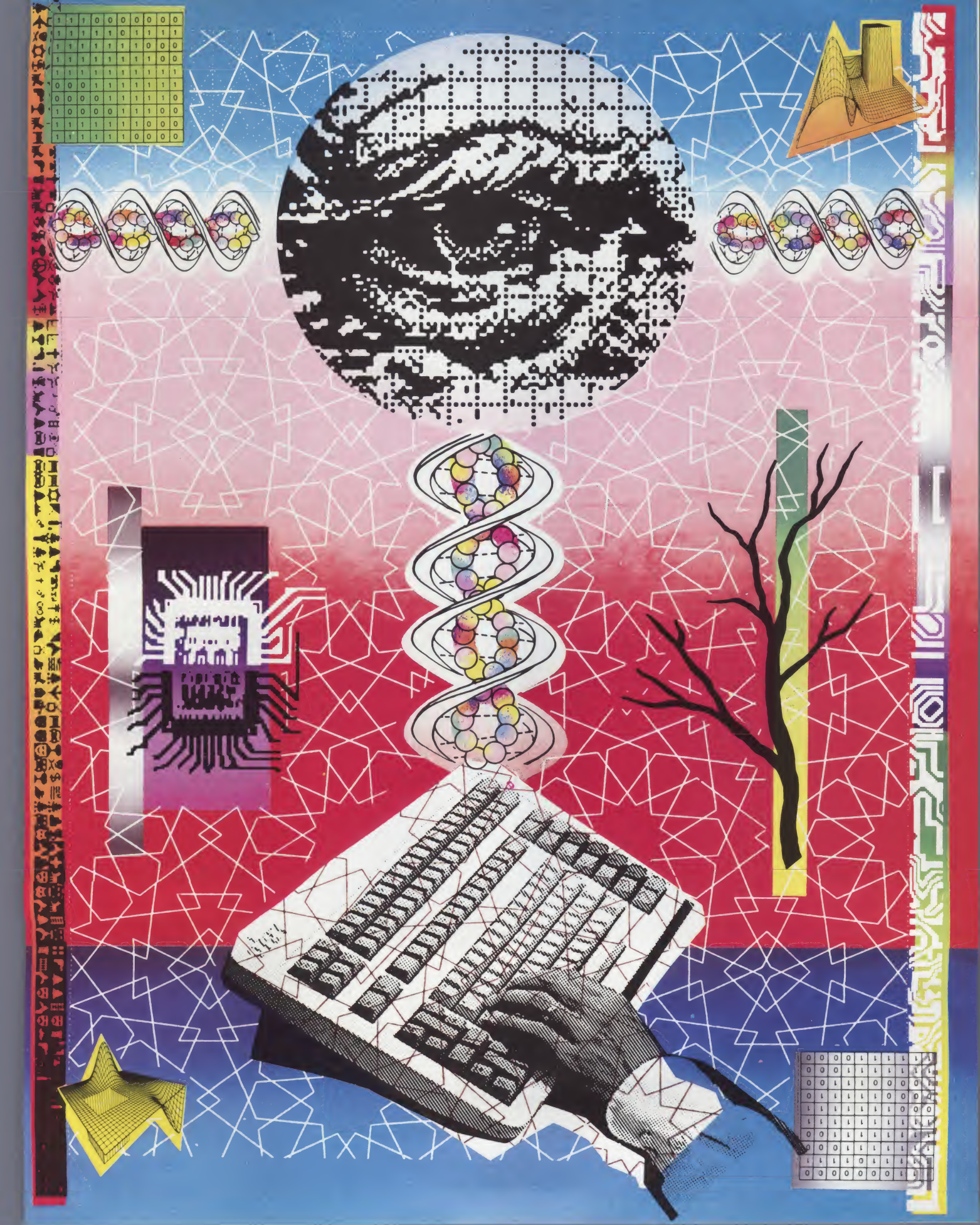
The pastrami in his sandwich is so tepid now, so nakedly greasy, that Dale has no appetite; instead he tears open the milk carton and dunks the oatmeal cookies. He punches his log-in name and password followed by a call to his program, DEUS. He taps the keys that conjure up the menu of transformations, each with its little symbol and viewport along the screen's left edge, each available to the bright triangular cursor controlled by the electro-optical mouse under his right hand. Another phrase on the keyboard causes to appear, with a quick yet not imperceptible electronic scrolling, a list of objects—**Tree, Armchair, Water Mite, Carbon Molecule**—that he or other students of computer graphics have modeled in wireframe, vector by vector, angle by angle; some are pure polygon meshes, constructed of points and straight lines, while in others curved 3-D surfaces are patched together with polynomial equations whose transformations in 2-D space involve calculations large relative even to the CPU's oceanic capacity.

In every case a complete, mathematically specified representation, an application-dependent solid, is stored in an ideal space that physically exists only as a huge string of 0s and 1s, closed or open switches, full or empty electronic pockets, within the gigantic RAM to which Dale, threading his way through the requisite keyboard strokes and processor commands, gains access.

The world, in stylized and specimen form, exists at his fingertips. Awe, or fear, touches him as his hands hesitate. He has no precise intention, no program of manipulations to produce the end result spelled out in his program's Promethean title; he proceeds by faith, trusting his prayerful intuition to guide him ever deeper into this maze fabricated to duplicate, in its essentials, created (can it have been uncreated?) reality. He knows that the graphics procedures available to his program represent a paltry number of objects as against the objects that exist on Earth, let alone in the universe; but his hopeful sense of it is that the number of bits involved in his representations and his transformations of them already approaches a number so high that, though infinitely (of course) short of infinity, it nevertheless cannot be regarded as a special case. The odds approach the infinitesimal that a conclusion true of a sample set so large will be untrue of the grand set, the enclosing and all-inclusive and divinely appointed set.

To warm himself up, Dale sets his luminous, nervously responsive triangle-pointer at **Carbon Molecule** and, setting his view volume at $10.0 \times 10.0 \times 10.0$, rotates it parallel to the screen's y axis, through $x = 100$. He taps out:

ILLUSTRATION BY MICK HAGGERTY





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```
(rotate
  (molecule (protein 293))
  (angles
    (from alpha)
    (to delta)
    (steps (* 0.001 (- delta alpha))))
  (shade S3))
```

Slowly, recalculated every thirtieth of a second, the leggy luminous molecule twirls, spidering on the invisible filament of the *y* axis. Cruelly, Dale calls for perspective projection and moves the viewpoint closer in, so that the calculations, the rapidly and tabularly approximated cosines and sines, arrived at tortuously through loop after loop, begin to excel the image refresh time and to impart a jerky, perceptibly effortful motion to the altering vector lines: the spider's limbs are creaking, the atoms composing carbon, represented as vertices, space themselves across the docile gray screen widely as stars—stars, those scattered, raging proofs of cosmic madness, those sparks in the velvet void of the overarching brain!

Next, to work himself into the program and its blasphemous attempt, Dale calls up from Memory the model labeled **Tree**, generated fractally—that is, “grown” by certain implanted principles of random subdivision tuned as closely as possible to the principles of organic arboreal growth. With a few rudimentary adjustments of parameters, indeed, the branching pattern of the **Tree** can be made to resemble the upward reaching of an elm or a Lombardy poplar, the downward droop of a willow or a pin oak, or the stately sideways spread of a dog-

**The black dots
dart and swarm
from one edge of
the screen to
the other like
midges above a
summer pond.**



wood or a beech. . . .

Dale on his plastic keyboard, its electrically supplied patter as delicate as the scrabble of rats, moves back into the viewing space, away from the plane of the screen, up into the **Tree**, where dots and small ovals indicate the height to which small boys, if projected into the mathematical woods, might safely climb. Each element of the array has its equation, which the machine can be made to disgorge in hexadecimal form, and which the dot

matrix printer on the other side of the cubicle—where Amy Eubank sits when Dale is absent and where she leaves her lipstick-stained Styrofoam coffee cups like love letters in another system of notation—will obediently print, in what is called a “dump.” Dale takes readings at $z = 24.0$, $z = 12.4$, $z = 3.0$, and $z = 1.1$, and the machine—another rat-noise, a terrible terrified high-pitched chattering—spews out, with a syncopated, somehow irritable bumping rhythm of rapid platen rotation, line after line of figures: these Dale scans for an abnormal, a supernatural pattern of recurrence. He especially checks the long accordion-folded sheets for 24 or any striking incidence of 2 or 4, which he has half decided are the sacred numbers in which God will speak to him—higher powers of the machine's brute 0 and 1, astraddle the traditional weary trinity, and one short of the ominous 5 we find grafted onto our hands and feet.

He encircles in red felt-tip 24s as they occur in the hundreds of polynomials and coordinates the computer has supplied. He cannot decide if the dancing activity of the red marks—the sense of a subliminal message activating mysterious connective currents—in the periphery of his vision flows from a transrandom statistical anomaly or from his own fatigue. He starts sweating. . . .

Since $z = 2.5$ constitutes a plane, then by setting z equal to the transformed coordinates of the model carbon molecule atoms Dale creates a series of more complex intersections, an array of traces on the gray screen that shifts as the angle of the **Tree** is shifted and the viewport and its scale are modified. He watches the screen intently, waiting for some pattern—a snowflake, a face—to emerge. The black dots dart and swarm from one edge of the screen to the other like midges above a summer pond, but Dale fails to see any message, any indicative configuration, in their staccato sway.

His idea has the simplicity of desperation: given that the three-dimensional primitives accumulated in this computer memory sufficiently represent the array of created things, by crashing them together—using one set of phantom polyhedra to clip another with its defined edgeplanes—he is giving God the opportunity to insert His version of the shape, the talisman, beneath all forms. Mathematically, since all these polyhedra and fractal patterns (as in the **Tree**) are stored as strings of binary numbers, a certain limit will be approached in the churning that constitutes, for God, an opportunity to declare Himself, even more clearly than He has declared Himself in the preposterous odds of Creation, the miraculous

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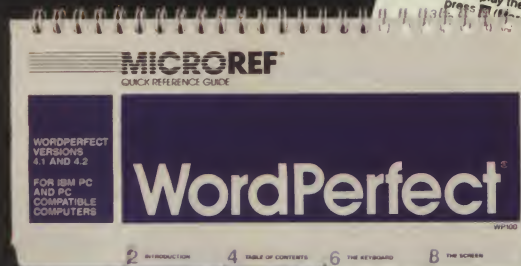
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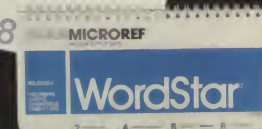
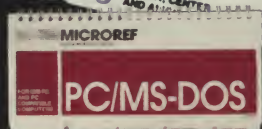
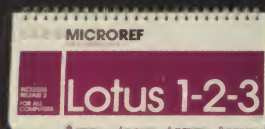
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aptness of the physical constants, the impossibilities of evolution, and the consciousness that flits above the circuitry of our neurons. The Devil's advocate within Dale, the intellectual conscience, might argue that God's opportunity already lay, sufficiently abundant, in the colossal vocabulary of form and information that stretches from here to the quasars, and that even upon our cosmically negligible planet exists as a virtual infinity of declared, achieved entities. If God, that is, did not speak clearly in the rain and the grass, or through Behemoth and Leviathan, why would a computer's plenitude of logic gates give Him voice? Because, Dale might answer, on the computer screen numbers become points and vectors of light and are available to our apprehension with the purity of syllogisms. Vector lines are potentially the bright bones of what is, as Wittgenstein put it, the case. Really, Dale's reasoning boils down to no more or less than prayer, a way of making himself vulnerable to visions: Byzantine saints and Plains Indians sought the same end with sleeplessness, flagellation, and hooks beneath the skin. In his nocturnal project there is something of self-mortification, an ordeal in which the computer is made to share. . . .

But beyond all this numerical quibbling Dale still hopes—he is greedy, spiritually greedy; he is climbing his Tower of Babel—for a graphic confrontation, a face whose gaze could be frozen and printed. Refreshed by yet another Coke with its increments of caffeine and carbohydrate, he tries to retrace the steps that gave him his haunting glimpse; he tries to ascend, gate by gate, through the immense binary maze that the mere touch of a button can reshuffle and double. He alters angles, he zooms, he changes parameters. He loses track of time. The small morning hours are much like one another. Vague sounds from elsewhere in the building—elevator doors opening and closing, cables singing in the black shaft, surges of humming on the floor below—indicate the presence either of other night workers or else of automated workings, of timers and thermostats inflexibly sending their signals. It has grown colder, outside and within. The coldness that, beginning in his fingertips and on the backs of hands, has traveled up through his wrists and forearms toward the cage of his chest he takes for Heavenly inspiration; in the microscopic maze where a single fleck of fallen dust would block a passage like a boulder and the finest hair come crashing down like a cathedral beam, he is drawing closer to the dragon, to the fire-breathing secret. As a child he would feel thus timorous descending to the cellar, where his father, in that

Akron house with thin walls, had set up the Christmas train, and whose obedient switchings and reversings proved to the boy a fascination and a mystery, as if a kind of corpse lay down here waiting to be activated, a spindly metal body with a narrow, heavy, alive head, the locomotive. The locomotive had a glowing single eye and, when touched to the tracks, its wheels would angrily spin. Working alone, conquering his awe and feeling of trespass, Dale became more adept at the mysteries of the Lionel than his father, and began to buy new equipment. . . .

He types **repeat**. The screen ripples; seconds pass as the necessary crunching is performed. The stripes and concentric tunnels of the preceding



**Byzantine saints
sought the same
end with
sleeplessness,
flagellation,
and hooks beneath
the skin.**

display have been subdivided into geometric fish scales. The hand has been folded in, has vanished, unless its shape has been reduced and transformed into the single green scale at the lower right of the screen, in the position of an artist's signature. Elsewhere, orange-red dominates; the fish scales have a certain optical alignment that leads the eye in, while yet remaining surface, remaining excited points in a film of phosphors backed by a super-thin mirroring film of aluminum. The machine is still locking him out of its secrets. Greedily, impatiently, his fingertips ask the VAX 8600 to **repeat** its gigantic loop once more.

The screen goes a cool gray, saying in unanswerable black letters **Insufficient heap storage**.

Dale feels wasted. He pushes himself back from the terminal. The skin of his eyes, the interface where vision meets light, hurts. The coldness of the place and hour have gone right through to his bones. He limps stiffly to the window; the moon is gone. The shreds of cloud have come to form a continuous blanket whose pewter color takes a yellow tint from the unsleeping streetlights of the city. In all the rectangular silhouettes of university and city buildings only a few windows are lit—bright slots spelling, in binary code, a word here and there. But of course, actually, a row of dead windows, of empty slots, spells words just as well. Zero is information also. ■

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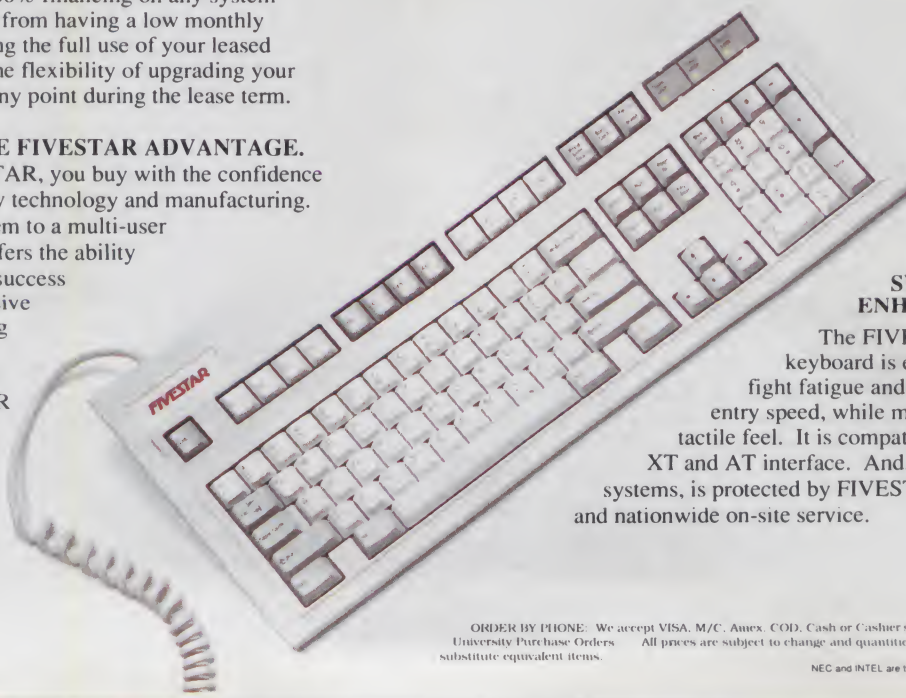
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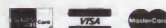
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CONNECT

By PRESTON GRALLA

What do pigeon racers, test-car drivers, balloonists, and Jersey City cops have in common? PCs, modems, and weather-tracking software. They're all using the most modern of technologies to track the most elemental of phenomena: the weather.

Not since the Great Flood have so many people been so concerned with the weather. People interested in such outdoor sports as boating and ballooning need to know wind speed and direction, and whether a late-afternoon thunderstorm may turn an otherwise pleasant outing into a struggle for survival. And farmers and offshore oil drillers alike have an economic stake in knowing what the weather has in store for them.

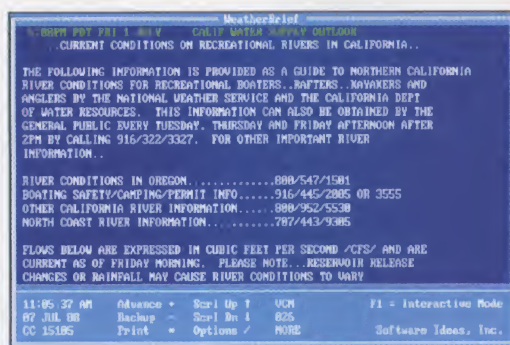
But our fascination with meteorology goes far deeper than matters of pleasure or money. There is also the sense that if we can understand the weather, or predict it more accurately, we can perhaps gain some degree of control over it.

To that end, PCs and modems are increasingly being used to tap into weather databases. And specialized software has been developed to manipulate the data, to turn the data into graphics, maps, and charts, and in general to help people better understand the invisible sea of forces that daily surrounds us.

Generally, weather information that you can get for your PC comes, one way or another, from the federal government. Agencies such as the National Weather Service and the Federal Aviation Administration maintain tracking stations or use satellites for collecting weather data. The information is then made available through

electronic databases. Private firms tap into this voluminous resource and then resell the information to the public.

Several packages allow you to dial into these private services, extract the information you want, and then use it in whatever form you need on your PC. They range from shareware programs, which tend to be rather rudi-



WeatherBrief has a series of menus you use to request data. You then dial into the database and download the data to view maps or plain-text descriptions of weather conditions.



The full-color maps WeatherBrief creates from the data you request and then download are attractive as well as informative.

Not since the Great Flood have we been so fascinated by the weather.

mentary, to sophisticated software that can create eye-catching maps and charts.

Market of the Millions

Dan Barstow, president of Hartford-based Metacom Software, which sells the Accu-Weather Forecaster, believes that the sky is literally the limit when it comes to the market for weather-tracking software.

"There are 500 million calls a year to the weather phone," he says. "That should give you some idea of the number of people interested in the weather."

Although people have always wanted such information, they have never had an easy way to get it. That is, in Barstow's view, until now. "Telecommunications is what's opening the market up," he says. "Before, getting information like this was too expensive or too technical. Now, software is available that's easy to use, inexpensive, and powerful."

CONNECT

As might be expected, Barstow holds out his own firm's software as an example of such a program. If the name of his company's package sounds familiar, that's because television and radio stations across the country forecast the weather by using the Accu-Weather database it dials into.

Because Accu-Weather Forecaster is aimed at a mass market, Metacommet has tried to keep it as simple as possible. The program is menu driven: you simply move a bar across the top of the screen until you've selected the proper items, and then hit Enter. As you go through a series of such menus, you can request quite sophisticated weather information.

Before dialing into the database, you use the menus to put together a request for weather information. It can be as simple as asking for the national forecast, or it can be incredibly complex. The Accu-Weather database compiles hourly reports from 1,000 weather stations throughout the United States. Aside from the usual data such as temperature, cloud cover, and barometric pressure, a number of special reports are available, including marine and aviation forecasts, crop reports, and 30- and 90-day outlooks.

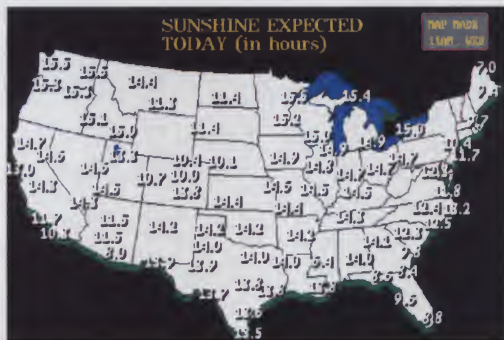
When you have put together your request, you dial into the database and retrieve the information. After you log off, you can view that information in map form, chart form, picture form, or as plain text.

People are as fascinated by maps as they are by the weather. Accu-Weather software falls short here: its maps have no color. And without color, even very sophisticated maps are not only difficult to read and interpret but are homely as well.

That may change: Metacommet plans a color version of the package. But until then, weather watchers who use this program will have to live in a monochrome world.

Lightning and Radar Maps

If you're after eye-catching weather maps that rival those found in *USA Today*, a better bet is WeatherBrief, from WeatherBank of Salt Lake City. The



Hours of sunshine expected across the country, as shown in this WeatherBrief map, will interest serious beachcombers as well as weather watchers.



This radar map from WeatherBrief shows past hour and current storm activity for the entire country.

program creates full-color maps that, quite aside from their utilitarian value, are visually exquisite.

Like Metacommet, WeatherBank, a weather consulting company, gets its weather data from various arms of the federal government. The company's software works in a way similar to that of the Accu-Weather Forecaster: using a series of menus, you put together a request for data, dial into a database, and download information. Once your computer has the data, you can view maps or plain-text descriptions.

Here, again, the variety of information is mind-boggling. Want to know the outlook for the California water supply? See a full-color map of lightning strikes across the country? Gaze at a current radar map of the Southwest?

Find out the total amount of rainfall for Wichita this month? You can. It's all in there.

A Natural Combination

Of course, getting that information will cost you some. Both Metacommet and WeatherBank charge for connect time to their weather databases. Depending on the type of use, time of day, and baud rate, Metacommet charges from 18 cents to \$1.17 per minute of online time. The software itself costs \$89.95.

WeatherBank charges a flat 20 cents a minute. The two WeatherBrief diskettes are free, because the company intends to make all its profits on its online service.

In neither case will dialing in break your bank account. In less than five minutes you should be able to get all the weather data you need.

Both companies expect that, given the low cost and easy access, weather hobbyists will get into the habit of using their PCs to download weather data.

But the question still remains: Given television's emphasis on weather forecasts, why would anyone need to know whether there's a blizzard warning halfway across the country, or whether lightning struck Lubbock, Texas, last week?

Steve Root, WeatherBank's vice president for marketing and development, thinks he has the answer. He attributes the explosion of PCs and weather watching to a basic human hankering.

"There's a psychological need to know more about the weather," he says. "And we're in the middle of an information age. Matching the growth of the PC with an interest in the weather is a natural combination."

Of course, our interest in the weather didn't begin with the PC. As Charles Dudley Warner wrote in an editorial for the *Hartford Courant* in 1897, "Everyone talks about the weather, but no one does anything about it."

Using a PC to track the weather may not help you to do anything about it, but you can have fun trying. ■

Preston Gralla is a contributing editor for PC/Computing.

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SHARE

By PRESTON GRALLA

Walk up a dingy flight of stairs, down cinder block corridors, and pass through a small office filled with junk food, cigarette butts, and more computers than should reasonably be crammed into such a small space. Stroll to the far side of the back room, and tucked away in a plain metal filing cabinet you'll find around a dozen plastic disk holders full of some of the most useful, innovative, and least expensive programs available today.

Welcome to the Boston Computer Society IBM PC Users' Group Software Exchange. This venerable organization has been distributing shareware and public domain programs since the earliest days of personal computing. The exchange started several months after the release of the IBM PC, when hackers and hobbyists found themselves with previously undreamed-of computing power, but with little software to run on the new machines.

In those days the exchange was primarily composed of the kind of people who not only bought commercial programs but also wrote software for themselves. It sprung up as a way for them to share their work and build up their own personal software libraries.

So far the exchange hasn't gone uptown, as the disheveled offices all too obviously proclaim. But the focus has clearly shifted. Vincent Gale, who as an associate director of the PC Users' Group guides the direction the exchange will take, says that it has changed because "the users have become less 'techie' oriented. Today techies are a relatively small part of the membership."

For that reason, people now rarely use the exchange to share software they've written. Rather, they purchase a catalog on paper or disk for \$5 (\$7 for nonmembers) and order programs from there. Members of the Boston Computer Society pay \$5 for each disk they order; outsiders pay \$7.

From that point on, the exchange functions in the traditional shareware manner: If someone likes the program, he sends the author a registration fee. If not, no more money is exchanged.

The several hundred programs range from the useful to the ridiculous to the sublime. Utilities, DOS shells, and communications programs are big. Topflight word processors, such as PC-Write, can be found alongside hard disk defragmenters. If you're looking for a billing system for mental health professionals or a fake spreadsheet that pops up with the click of a key to fool your boss into thinking you're actually working, the exchange is the

place to turn.

All in all, the Software Exchange's catalog is like an Arabian bazaar for software adventurers.

Those who run the exchange aren't

The Boston Computer Society's Software Exchange: an Arabian bazaar for software adventurers.

driven by a profit motive; all work is done by volunteers. Any money made from the sale of disks is plowed back into the Software Exchange or the users' group.

Joe Sireci is typical of the volunteers. A great bear of a man, he takes time out from his busy schedule as an analyst with a management and pro-

A Shareware Sampler

The Boston Computer Society IBM PC Users' Group Software Exchange Catalog is a browser's delight. You can choose from several hundred programs, and part of the fun is thumbing through the catalog itself. Following are edited excerpts:

- **Automenu.** A sophisticated system to create menus that access frequently used programs and perform DOS commands with a single keystroke.

- **Burnout.** A versatile screen-blanking utility to protect your monitor.

- **Compare.** Allows you to compare two ASCII text files.

- **Express Calc.** An easy-to-use spreadsheet.

- **Galaxy.** Word processor with pull-down menus and WordStar-like keyboard commands.

- **Hercsnow.** Displays snowflakes on a Hercules card. If you've ever wondered why you bought a Hercules card, here is the answer.

- **Jokes1.** A disk of several programs that "turns your monitor upside down . . . puts your computer through a wash-and-dry cycle . . . or displays a fake spreadsheet when you press a hotkey."

- **Monopoly.** The classic

board game.

- **PC-Key-Draw.** Keyboard-to-screen graphics program for low-resolution drawing.

- **PC-File+.** A menu-driven database.

- **PDSW.** Public domain utility to print sideways.

- **TSR.** Programs for managing DOS memory.

- **Tutor.** An interactive menu-driven tutorial about IBM PCs and DOS.

- **Undel.** A file recovery program.

- **Snapshot.** Captures and saves the contents of your computer screen.

SHARE

gramming consulting firm to devote ten hours or so a month to the exchange. When asked why he volunteers, he first offers a tongue-in-cheek answer: "All you have to do is ask for help, and they'll suck you into a job and a committee somewhere." But later, he adds that he does it "to give back some of the time the BCS has given to me—some of the time and knowledge."

Sireci sees a practical as well as a philosophical side to the shareware phenomenon and to the Software Exchange. In the pragmatic realm, he believes that "on the whole, shareware is as good as, or even better than, commercial programs." As for the software authors, he thinks the benefits transcend the monetary rewards.

Shareware authors "don't want to sell out to big publishing houses," Sireci maintains. "They want the opportunity to show what they can do,

get credit for their work, and make a little money on the side. And they take more care with their programs because their name is on it rather than the name of a major corporation."

Getting a program listed in the Exchange's catalog is not necessarily easy, he notes. Reviewers evaluate every program, and turn thumbs down on some of them. Often members critique a program that doesn't pass muster, giving the author an opportunity to improve its chances for sale.

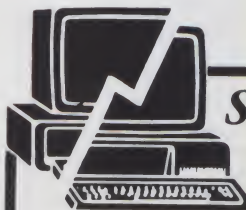
Many of the programs listed in the catalog are also available from bulletin boards. But Sireci points out that in these days of computer viruses, ordering software through the exchange's catalog rather than downloading it is one of the best ways to practice "safe computing." Because the exchange gets its software directly from the author, it is less likely that someone has had a chance to attach a

hidden virus.

The kinds of programs available from the exchange changed once—when membership shifted from hackers to general users—and associate director Gale believes it will change again. In the future, he predicts, the exchange will offer fewer general-purpose software programs such as word processors, and more utility programs designed to work in concert with commercial software, such as add-ins for 1-2-3.

But whatever the kind of software available, the lure of getting something new for little money will always be strong. As Sireci says, "As long as something does the job, I'll try it. And \$5 isn't that large an investment to see if it fits." ■

Preston Gralla, the former managing editor of PC Week, is a contributing editor for PC/Computing.



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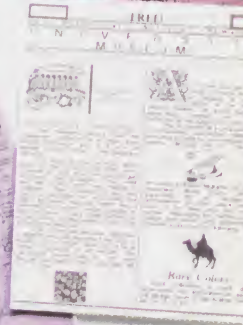
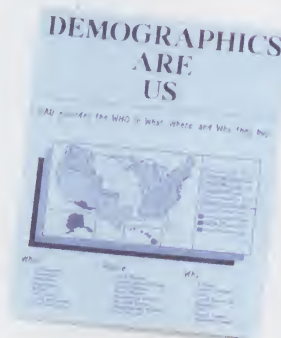
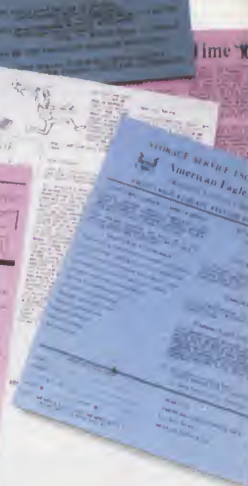
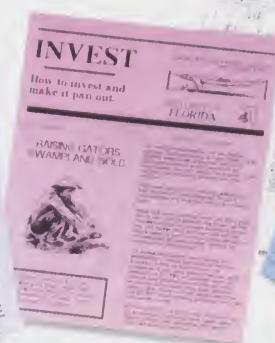
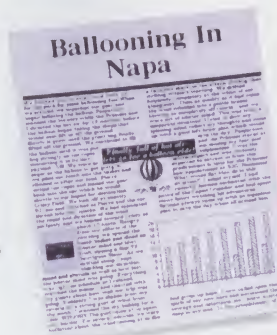
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PopDrop will also let you manipulate programs that reside in EMS—so you won't have to perform mental gymnastics just to "make room" for programs you need to run. PopDrop is an excellent tool for making different software resident when you switch to another program. And PopDrop won't interfere with your backup program.

Voted one of "The Best Of The Best Utilities" by *PC Magazine*, PopDrop is one program you shouldn't be without.

PopDrop Divides Your RAM Into "Layers"

PopDrop works by dividing your memory into layers (up to 16) each of which may contain several programs. After loading DOS and your permanent programs, RAM-resident programs are loaded with these layers between them, the most permanent at the bottom, the least permanent at the top. You can create batch files to remove layers one at a time or several at once.

And PopDrop Is Amazingly Memory-Efficient

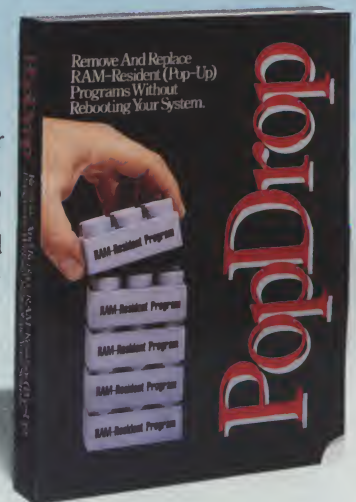
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Control Your RAM Instead Of Letting It Control You

For example, if you want to run a RAM disk, a print spooler and one or more pop-up programs most of the time, but need them out of the way to work on a large spreadsheet, you can do it easily with PopDrop. If you need different programs resident when you switch to another application—it's no problem. In fact, you can easily use PopDrop in your batch files to make this automatic.

In addition, PopDrop will let you "activate" and "deactivate" programs in a specified layer of RAM to avoid conflicts with the program you're using.



PopDrop is available in 5 ¼ or 3 ½ inch diskettes.

It is compatible with the IBM PC or compatible and the PS/2.

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EUROTECH

By PETER WHITE

Mention a Professor Brainstorm-type eccentric British inventor and most people will conjure up something approaching bald, bespectacled Sir Clive Sinclair. Sir Clive is the designer of such great leaps forward as the first mass-produced electric car (a dismal flop), the flat 2½-inch TV screen (he beat the Japanese into production with one), and a handful of market-shattering personal computers dubbed the ZX range, which are best known in Europe. The ZXs are now part of the ever-growing Amstrad empire, to which Sir Clive sold the venture.

Now ensconced among the academic spires of Cambridge, a sleepy train ride from London, Sir Clive probably got the idea for his latest foray into computers during painfully boring journeys to the capital.

Sir Clive's new brainchild is called the Cambridge Z88, and your first delightful impression as you take it from its box is that it is so light, someone must have forgotten to put the electronics inside. Immediately you might ask, "Where are the disk drives?" The fact is there are none, which starts a worrying series of thoughts along the lines of, "How am I going to get data to and from my desktop IBM-compatible PC?"

This gets to the heart of what the Z88

is really about—serious portability and "no tears" translation into PC-DOS machines, especially for WordStar users. Sir Clive clearly realized that the only thing computer users on the move need to do is input data in retrievable form.

So he's built a machine, based on the Zilog Z80 chip, that weighs less than 2 pounds and is about the size of a letter-sized paper pad. And on close inspection, you'll discover that the Z88's slightness doesn't compromise its functionality or compatibility.

Power is provided by four ordinary AA batteries, which in the machine's unexpanded version give you about 20 hours of working time. The display is an eight-line, 100-column supertwist LCD. The Z88 uses solid-state storage, with additional memory capacity provided by EPROM cartridges that fit into slots on the front of the machine.

Even when the screen display is switched off, everything held in the computer's memory is maintained—so long as the batteries have sufficient power. The screen displays a warning when the batteries are getting low, and an internal capacitor will keep the

power going for up to six minutes while you're changing them. If you're using all three slots, however, you'll have only about 60 seconds to make the change.

Software is provided by an integrated package called Pipedream, which incorporates word processing, spreadsheet, and database capabilities. The machine also comes with pop-up utilities, including a clock, a calculator, a diary, an organizer, and an alarm reminder.

The standard Qwerty keyboard includes a few unusual dedicated keys—Index, Menu, Help, and a key marked with a square and another with a dia-

Sir Clive's Z88 road machine—as light and small as a book, as wacky as its inventor.



Eccentric British inventor Sir Clive Sinclair can add a notebook-sized computer to his list of accomplishments.

mond—that are linked to features of the software.

Pressing the Index key returns the user to the main command level of the software and suspends the current operation. The Help key gives context-sensitive information about the current operation. The Menu key lets the user make selections regarding the current application; each menu selection is displayed with a shortcut equivalent that can be used in lieu of entering the full command.

The square and diamond keys are the prefix keystrokes for making shortcuts. The square introduces a shortcut for calling an application; the diamond precedes a shortcut for carrying out an operation.

The keyboard is covered by a rubber mat, which gives a dead feel to the keys but insulates the machine from contamination. It is virtually noiseless unless you activate the toggle to introduce an audible click for each keystroke.

Another unusual feature of Pipedream is its page-display map, which

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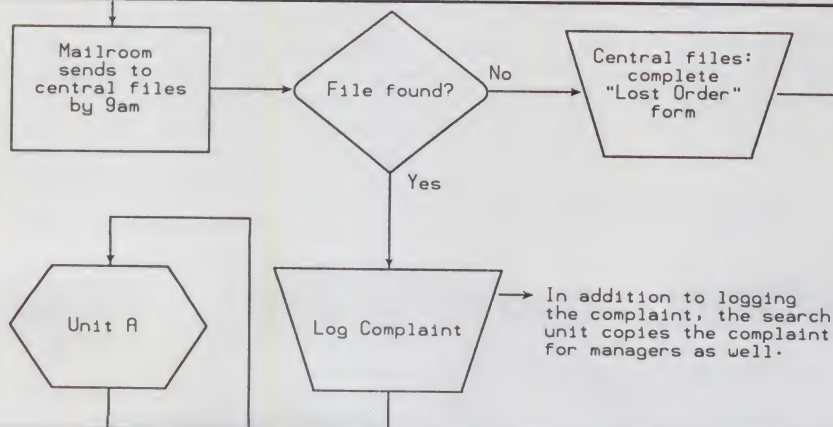
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appears on the right side of the screen and shows the layout of the whole page. It allows you to start formatting a document while you're still in transit. If you're downloading to WordStar, it can even retain print commands in a file after it's been dumped to DOS.

At the end of a journey, the downloading procedures are simple and reliable, expedited via a cable using a 9-pin RS-232 serial port and PC-Link II communications software. The software for the transfer resides in a 32K

The Z88's biggest attraction is its price. The basic machine costs only \$549.

EPROM cartridge in one of four Z88 slots and on a floppy on the target machine, which controls the download.

Not the least of the Z88's attractions is its low price. The basic machine costs \$549 in the United States, although for this you get only 32K of memory. Expansion cartridges are available in 32K, 128K, and 512K packs, but a 512K cartridge together with a PC link will almost double the initial price.

Sir Clive's Z88 will be distributed in the United States by Cambridge North American, a subsidiary of Diversified Foods, a \$150-million-a-year Portland, Maine, grocery wholesaler turned computer distributor. Diversified took a warning shot across the bow from Amstrad as it lined up to use the Sinclair name, which went legally to Amstrad when Sir Clive sold the ZX line to the company. Diversified finally agreed to rechristen the venture.

Cambridge North American hopes to be moving the Z88 through computer stores and major retail outlets offering various promotional discounts. To help the machine get off the ground in the U.S. market, the company has signed a letter of intent to acquire 51 percent of its first dealer, Executive Computers, a four-year-old laptop specialist in New York City that sells to 800 of the Fortune 2,000 companies. ■

Peter White is with APT Data Services in London, publisher of the Computer-Gram International news service.

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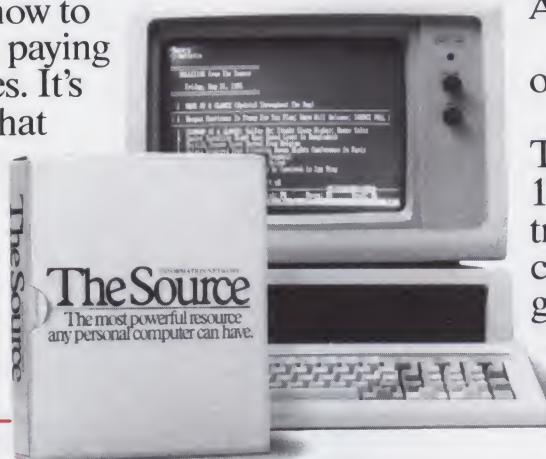
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MEDIA

By KRISTIN R. WOOLEVER

Most of us who use word processing software have been frustrated for years by the two-ton manuals that come with the disks. Not only does the documentation look intimidating, but its density makes it nearly impossible to find quick answers to simple questions.

"I'll just check the table of contents," you think as you squelch your creative muse for the moment to find out, say, how to number your pages. But you read through nearly the whole table of contents before you finally see "Page Number," and thumb through the manual to the appropriate section. It reads: "The PN (Page Number) command outputs the current page number in the text wherever it is placed... to automatically number the pages, it is used with the Running Header or Footer command. (Refer to the Running Header and Running Footer descriptions in this section.)"

After returning to the table of contents to find the page numbers for the running header and footer sections, and after getting no help from them, you try the index. Fine. But there you run into more problems. Do you look under "Page number," "Page number field," "Page number indicator," "Page numbering," or "Page Number command"? You decide to number the pages by hand and finally return to your muse, only to find her long gone.

That's what it was like to use the documentation for XyWrite II, the XyQuest Corporation's popular word processing program. It was bulky, poorly organized, and written for computer programmers, not writers.

Fortunately, things have changed. The documentation accompanying the new XyWrite III Plus shows that XyQuest has learned its lesson. The company is now producing documentation users can really use.

The logic of XyWrite II's documen-

tation was its worst fault. The lengthy user's manual tried to be everything to everybody. The guide crammed together an introduction for the new user, a lengthy tutorial, a reference section, and a section on the program's advanced features—all in four chapters. Because each section had a different purpose, each had a significantly different format—creating confusion for even the most studious user.

Adding to the frustration, the refer-

of some in the computer industry that documentation is a luxury—an extra tacked on at the end of product development and always at the mercy of budget cuts.

The XyWrite III Plus guide, on the other hand, reflects the industry's new attention to documentation as a marketing tool. The changes in the XyWrite manual from 1983 to 1987 illustrate a shift in attitude that says that if a program is made easier to use, more

With its elegant, readable manual, XyWrite III Plus proves that software documentation can really work.

ence section either repeated much of the tutorial's information or fell victim to the sin of "go to" documentation. Let's say you wanted to know how to edit your source files in expanded mode. If you checked "Creating and Editing Program Source Files," you were told to go to the "Tab Set" section and then to the "Margin" section to get complete information.

If that wasn't enough to send most users to another software program, perhaps trying to follow the tutorial was. The table of contents for the tutorial chapter didn't match the actual subheads within the chapter. Several entries in the table of contents did not appear on the pages indicated in the chapter itself. The information may have been there, but the subhead to cue the user was worded differently or missing altogether.

Poorly designed pages, shifts in style, weak proofreading, and the total absence of graphics compounded the weaknesses in XyWrite II's documentation. The manual looked and read like an afterthought. Unfortunately, its flaws reflected an attitude on the part

people will buy it.

Though even heftier than its predecessor, the XyWrite III manual is better designed, better organized, and much better written.

Beginning with a new script logo and a handsome, blue-striped section title at the top of every page, the documentation immediately looks more readable, less technical. The typeface, though smaller than the previous version's, is softer and uses boldfacing more creatively. The new font is easier to read and lets you shift between computer screen and manual page without straining your eyes.

But it's the new documentation's organization that really sets it apart. The manual is called a Reference Guide, and it lives up to its name. It serves *only* as a thorough reference—not as a tutorial, an installation guide, a quick reference, or a kitchen sink. For those who prefer tutorials, XyQuest provides three separate manuals for different needs—Quick Start, Basic Word Processing, and Applications—leaving the Reference Guide to do its job in one format.

The manual is sensibly task-oriented

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MEDIA

and arranged into six chapters: Getting Started, Filing, Editing, Formatting, Special Features, and Customizing. Under each heading in the table of contents is a clear, action-oriented sub-head. And you can read the manual in any order without the frustration of "go to" directions.

All the sections use the same structure, so you know where to look for information without wading through different formats. In XyWrite III Plus, the chapters proceed by first explaining a command's *format*, then its *purpose* and required *user action*; the sections conclude with *notes* about the command's various applications. Every page follows this structure, creating a pattern that allows you to find information easily and quickly.

There is a useful consistency in the graphic design as well. Nearly every page has a screen or drawing to illustrate a concept explained in the text. The illustrations are handy for quick reference, and they make the manual more readable, too. You no longer have to imagine how the screen should look: just check the example on the page. The graphic elements are also employed to create more space around the text, so you can digest smaller chunks of information.

Even the sentence structure of the XyWrite III Plus Reference Guide exemplifies the new attitude toward documentation. The old XyWrite II documentation labored through phrases such as "integrated text preparation and output formatting program," stifled itself with excessive passives and nominalizations, and read like a programmer's notes. The XyWrite III Plus guide speaks directly to intelligent users who need to get a job done without spending hours translating the manual.

XyWrite III Plus has sensible, easy-to-use documentation written for writers. Its practicality is a good example of the increased industry attention to developing documentation whose quality lives up to the hardware and software it describes. In just the four years from 1983 to 1987, computer documentation has come a long way. Its newfound industry respect has been well earned. ■

Kristin R. Woolever is director of technical and professional writing programs at Northeastern University.

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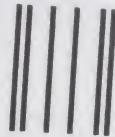
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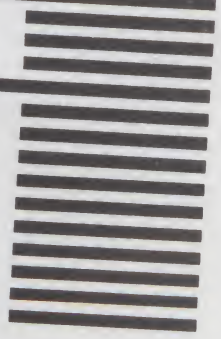
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IMPACT

By JOHN A. FARRELL

The software is called Gerrymander. And after the next census, few American politicians will be able to survive without it—or something very much like it.

In the wake of the 1990 census will come reapportionment, the process of redrawing the boundaries of political districts to reflect changes in the population landscape. The Rust Belt will forfeit seats to the Sun Belt, urban ward heelers will lose precincts to the suburbs, and members of the minority party in every district will face gerrymandering—vicious assaults on their historic fiefs by a raptorial majority.

In past bouts of redistricting warfare, most politicians found themselves at the mercy of powerful statehouse officials who had the resources, staff, and technical expertise to gerrymander—to redraw political boundaries to their own advantage. But not in 1990. Not in an age when computers are pervading the fast, high-stakes business of politics.

Enter Gerrymander, software for the new politics. "It's very powerful stuff, very sexy," crows John Aristotle Phillips, cofounder and president of Aristotle Industries, the Washington, D.C.-based company that's developing the software. Phillips is no stranger to political controversy. In 1976, as a 21-year-old Princeton undergraduate, he captured national attention with a senior physics project that explained, in



The Dukakis campaign's Tad Devine and Pamela Lowry: "You can break politics down to numbers and people."

elementary terms, how to build an atomic bomb. It brought him instant national celebrity. He later chronicled his nuclear adventures in the book *Mushroom: The Story of the A-bomb Kid*.

The boy wonder has since turned to software. "Gerrymander allows you to use a mouse with a personal computer,

moving across your district map, rearranging boundary lines to see if you're going to be reelected or not," says Phillips. Guided by demographic data and the results of past elections, the software enables politicians to redraw dis-

"Gerrymander allows you to see if you're going to be reelected."

trict lines on PCs. The results may well be egalitarian pandemonium: "You'll have bunches of legislators running through the statehouses, each with their own maps," Phillips says.

Aristotle is just one of several companies—Grass Roots Software Systems and Campaign Software are among the others—that specialize in applications of computers to politics. And using computers to redraw political districts is but one example of a trend that has grown rapidly in the 1980s. Advances in software and in powerful and relatively inexpensive micro- and minicomputers have made the computer a standard feature in the campaigns of presidential prospects, House and Senate candidates—even contenders for obscure local offices. Says Phillips: "We've had moms running for school boards using their kids' Apples."

Campaign Industry News, a Washing-

ton newsletter owned by Aristotle Industries, estimates that candidates for federal office have already spent some \$20 million on computers and computer services this year. "You can break politics down to numbers and people, and the computer has become essential in keeping track of both," says Pamela Lowry, director of computer operations for the presidential campaign of Massachusetts governor Michael Dukakis. "It's limitless what you can do."

The Dukakis campaign, for instance, leases a Digital Equipment Vax-11/750 superminicomputer, a MicroVax II, and several dozen PCs. Lowry joined Dukakis in 1979, "when all we had was two typewriters and boxes of file cards," she says. Now she uses the Vax mainframe to select supporters from a database of more than 150,000 households, print their names on mailing labels or get-out-the-vote lists, and write them personalized letters—"all in a wink."

When Tad Devine, the Dukakis campaign's chief delegate-tracker, held the same job for Jimmy Carter in 1980, he laboriously listed delegate information in a series of notebooks. This year, Devine just cranked up the MicroVax, where a program called Deltrack gave him detailed esoterica (occupation, nickname, depth of enthusiasm, affiliation with interest groups, favorite issues, and personality quirks, for exam-

**Thomas Hofeller
analyzes the voting
habits of 70 million
citizens.**

of computer services, this \$2 million accumulation of high technology analyzes the attributes and voting habits of 70 million U.S. citizens—a large share of the nation's 120 million registered voters—and is connected to local Republican-party headquarters in every state.

The Republicans also store information on their opposition: voting records, excerpts of interviews and speeches, and lists of financial contributors. President Reagan's advisers used one such Republican database, called Quotes, in preparing him for the debates against Walter Mondale in 1984. In planning a televised attack last spring, aides to Sen. Robert Dole of Kansas used the Presidential Campaign Hotline, an electronic bulletin board, to dig into Vice President George Bush's record.

The Democrats have vowed to catch up, and both political parties are now



The Democrats have vowed to catch up to the Republicans, and both parties are investing in scanner technology.

ple) on 6,000 Democratic chieftains, delegates, and alternates.

Still, Dukakis and other Democrats are neophytes when it comes to computer technology. The pioneering work in the field was performed by the better-heeled Republicans, who have institutionalized campaign high technology.

At Republican National Committee headquarters in Washington, two clustered Vax processors, a MicroVax II, and a Wang word processing system cram a room half the size of a basketball court. Under the watchful eye of Thomas Hofeller, the party's director

investing in scanner technology, using computers to store newspaper articles and other public information for political ammunition.

Computers are also finding a place in political advertising. Want to know how many female college graduates over 30 years of age, with incomes of more than \$50,000 a year, can be reached by buying time on "The Cosby Show"? Ask Catherine Farrell. President of New York-based Farrell Media, Farrell has been building a media database on her IBM mainframe for ten years. Her computer can chew through ratings and demographic data

from all 210 American television markets and tailor candidates' advertising to local needs. "The computer will just spit it out," says Farrell, who worked for Reagan in 1984 and will be buying media time for the Bush campaign this fall.

Tough federal requirements make computers an essential part of campaign fund-raising reporting, and at least one presidential candidate dabbled this year with a computerized marketing tool: Rep. Richard Gephardt of Missouri recorded a "personal" campaign message that was sent by phone, via an electronic dialing system, to thousands of Michigan households. The Dukakis campaign's Lowry thinks the technique in general is "eerie," impersonal, and counterproductive, but Phillips believes that such messages, recorded by popular political figures or celebrities, may be a wave of the future.

A two-time loser in his own tries for Congress, Phillips turned to the burgeoning software industry in 1983 after persuading his brother Dean, an MIT graduate, that there was money to be made by providing computerized political help to seekers of the half-million U.S. public offices that open up every four years. "I don't want to oversell the stuff; good software won't make a bad candidate a good one," he says. "But in a close race, it can make a difference."

John A. Farrell covers presidential politics for the Boston Globe.

PHOTOGRAPH BY RUVEN AFANADOR

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DOS

By BILL TRAVEN

You're lost in the untamed thicket of your hard disk. You wander through directory after directory, having forgotten where you've stored important programs, wasting time searching for the right subdirectory.

You can blame DOS for this all-too-commonplace predicament. DOS is unforgiving: it won't let you easily run a program, or use certain files, from one subdirectory while you're in another. Nor does it make it easy for you to run command files (those containing programs or collections of DOS commands) from a directory other than the one where the files reside.

Fortunately, DOS offers a way out: the Path command, which blazes a trail through the jungle of data on your hard disk and makes computing a pleasure rather than a frustration. The few minutes it takes to put a Path command in your Autoexec.bat file can be one of the most important steps you can take to make your hard disk live up to its reputation as a time and labor saver.

You need a Path command because of one of DOS's many quirks. Early versions of DOS require that whenever you type a DOS command or run a program, you first change to the directory where that particular command file is stored. Later versions let you get around this, but only after you've done a good deal of extra typing.

So, for example, you'd have trouble if you were in the subdirectory \DBASE\DAT and wanted to use a DOS

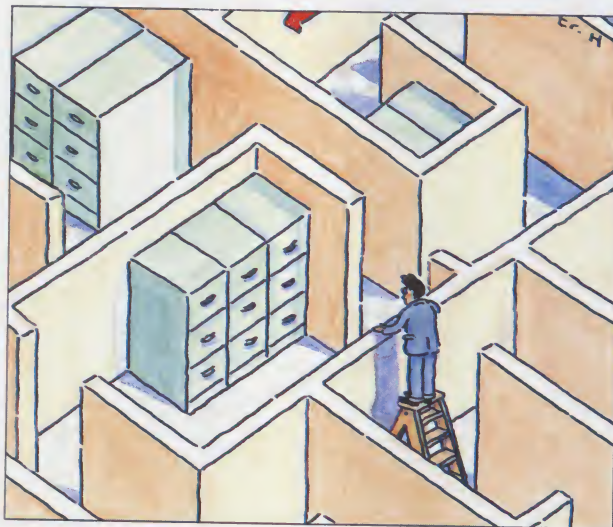
command but your DOS files were in the directory \DOS.

To banish the trouble, issue a Path command, telling DOS which directories and subdirectories to search when looking for a file. In the above example, you'd issue the command

```
PATH=C:\DOS
```

your Autoexec.bat file, which contains commands that DOS carries out each time you start the system.

If it turns out you don't have a Path command, that's no problem: creating one is simple. At the C prompt, type "Path=" and then a list of the directories and subdirectories you want in the path.



With a Path command, you won't need a machete to clear the way through your hard disk jungle.

You can name as many directories as you like in the Path command, separating them with semicolons. Keep in mind, however, that the more directories you specify, the slower the system will become.

Although your directory names won't necessarily match those described here, you'll probably want to include at least the following directories:

- The root directory, named \ (the backslash character).
- The directory that contains your DOS command files, named \DOS. If your DOS files are in the root directory, consider moving them to a directory you name \DOS to keep your root directory as free of clutter as possible.
- Directories for the application programs you use, such as a word processor, spreadsheet, or database.

You could then run DOS commands from any directory or subdirectory.

Even if you haven't put in a Path command yourself, there may be one on your system if someone else set up your computer for you. The way to find out is to type "Path" at the C prompt. If no path has been defined previously, DOS responds: No Path. If a path has been put in, DOS shows you the directories in the command path by issuing a message something like this:

```
PATH=C:\; C:\DOS; C:\WP; C:\123
```

If a path exists but you didn't define it, the Path command is probably in

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DOS

- A directory named \BATCH for batch files.
- Depending on how you use your computer, you might also want to include a directory such as \PGM for utility and general-purpose programs or \BASIC for programs written in Basic.
- If you use a RAMdisk and copy program files to it, be sure to include its directories in the Path command.

Blazing a Path

Suppose you want to be able to use command files in the root directory and in directories named C:\WP (for the word processor), C:\BATCH, C:\PGM (for some utility programs), and D:\ (for your RAMdisk). You would type the following Path command:

```
PATH=C:\;C:\WP;C:\BATCH;C:\PGM;D:\
```

To verify the results of this command, type "Path" to tell DOS to display the current command path, as you did earlier.

When you use the Path command, to define a command path, DOS removes any command path currently in effect. But there's a way to experiment with the Path command without losing the current command path.

Type the following Path command to create a batch file that will re-create your original command path after you've changed it:

```
PATH > PATHREST.BAT
```

The > (greater than) symbol in this Path command tells DOS not to display the output of the Path command but rather to store it in a file named Pathrest.bat (for Path Restore). When you want to put your original path back in place, type "Pathrest," and the file will re-create your path.

The Path command is best used in an Autoexec.bat file, rather than from the C prompt. That way, every time you turn on your computer, the file automatically issues the Path command.

With a Path command in place, you may never again find yourself frantically switching from directory to directory, looking for the proper command file. And you won't need a machete to cut through your hard disk jungle. ■

Bill Traven, a well-known computer consultant, is based in Philadelphia.

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THE SOFTWARE LINK

LEARN

By ANNE STUDABAKER

Zut alors!

C'est exacting, c'est unforgiving—c'est French-language software.

Remember *le professeur*? The strict French teacher who patrolled *la classe*, eager to pound the desk of any *étudiant* whose *cahiers* were not quite *magnifique*? Well, he's back, and writing programs for Gessler Educational Software. At least that's the way it seems when you first peruse three French-language software packages from this New York-based company.

Ticket to Paris, La Guillotine, and Bataille de Mots can beef up your *vocabulaire* better than any drill instructor. And they're fun, too.

Although designed for classroom instruction, the programs are affordable enough for home use. If you're preparing for *les vacances* abroad (Gessler offers German and Spanish tutorials as well), these software packages may be just the *bon voyage* you need.

Ticket to Paris

Available in French or English, Ticket to Paris gives you a mission: find your lost cousin in the City of Lights. With a bit of cash in your pocket, you search *tout le Paris*, answering questions about French culture, language, history, art, banking, and shopping. Each time you answer a question correctly, you get a clue to your cousin's whereabouts.

This program is the most challenging of the three reviewed here, and its questions make it the most interesting. After you land at the airport, you have to choose your mode of transportation into the city. As you make selections—hotel, food, transportation—your purse gets smaller and smaller. So if you don't go to *la banque* to exchange

your dollars for francs once in a while, you can wind up washing dishes at *le bistro*. And if you choose to walk from one corner of Paris to another, you can wind up in the hospital from exhaustion.

The clues and questions range in difficulty from simple ("How do you say *lettuce* in French?") and "See the statue without arms") to obscure ("Join me at some old movies" and "Taste the creamiest ice cream"). Although you may start out guessing, the program provides a clues-and-solutions sheet you can peek at if you feel the urge to crib.

After a few humiliatingly low scores, I figured out where to go for food and wine, bridges and statues, clothing, and cures for physical ailments. And like true tourists, I kept running out of money.



Ticket to Paris reveals language problems all tourists face.

The software's visual effects are meaningless, and the graphics are lackluster—but they are the most interesting of those of the three programs. What I enjoyed most was the little figure on the bottom of the screen, representing you, the player. The figure shows hunger as a red spot on its stom-

ach and fatigue as pain signs emanating from its head and feet.

On a scale of 1 to 4, with 1 as poor, Ticket to Paris rates a 3 for graphics, 4 for difficulty, 4 as a learning aid, and 3½ for fun.

List Price: \$39.95

Requires: 256K RAM, DOS 2.0 or later, and a graphics card.

French-language software can beef up your *vocabulaire* better than any drill instructor. It's also fun.



Built around an adventure, it's more fun than learning by rote.

La Guillotine

Designed for beginning and intermediate French students, La Guillotine is a variation on the old hangman game. The vocabulary includes such gems as *le drapeau*, *le week-end*, *le grenier*, *le pourboire*, and *le casse-croûte*.

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**La Guillotine: A French
version of hangman.**

classe, jours/mois/saisons/temps, à la maison, au restaurant, professions et métiers, or a pot-pourri of these—the user can either review the words or play the game.

The game is set in revolutionary France. A crude figure lies prone beneath an executioner's blade. If you spell the word correctly, the man is spared; he turns his head, grins at you, and waves the French flag while a few bars of "La Marseillaise" play in the background. If you get the word wrong, the blade drops and chops his head off—yes, it's as gruesome as you'd imagine.

With its missing letters and strange graphics, this program just didn't hold my interest.

La Guillotine gets only a 1 for graphics, 2 for difficulty, 2 as a learning aid, and 2 for fun.

List Price: \$29.95

Requires: 128K RAM, DOS 2.0 or later, graphics card.

Bataille de Mots

A tough tutor, Bataille de Mots instructs beginning and intermediate students in 450 French nouns, adjectives, and verbs. It's excellent for honing spelling skills but provides no hints, even if you're close. For example, you may know that the word for *needle* is pronounced something like "a-guoy," with a long *a*; you know it has some *l*'s in it, so you try "aguille." The software says "Dommage" and asks you to try again. Since the correct spelling is *ai-guille*, couldn't the program have said "Close . . . try again?" as it does if you merely forget an accent?

Bataille de Mots is an excellent instructor, and the game part is OK too. After choosing one of six topics—at the dining room table, sports and leisure,

travel and transportation, school, work and professions, and daily life—you can try your luck at adjectives, nouns, and verbs that describe activities in these areas.

You can practice with a vocabulary review (which provides the word, a translation, and common use in one sentence) or just a quick scan (which merely spells the word and translates it). You then proceed to a multiple-choice quiz, a fill-in-the-blank quiz, or the game itself.

The quizzes are unforgiving. If you disdain reading instructions, it may take several tries before you figure out how to produce the required accents (several strikes of one or another arrow key will

**A man lies prone
beneath the
executioner's
blade. His fate
depends on
your vocabulary.**

change the accent). If you select the wrong option, the program alerts you by dinging, but a right answer produces a pretty little ditty or a few bars of "La Marseillaise."

The game is easy. It's set up like an arcade shooting gallery (with appropriate pinging noises). An English word appears in a box at the bottom of the screen, and an armed man takes shots at French words that scroll across the top of the screen. Your task is to make him shoot the correct French translation of the English word.

Sounds simple, and it is. It's also a virtually painless way to memorize vocabulary lists.

Bataille de Mots earns only a 1 for graphics but scores a 3 for difficulty, 3 as a learning aid, and 3 for fun.

List Price: \$49.95

Requires: 256K RAM, graphics card. ☒

Anne Studabaker is a freelance writer living in New York City.



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PARALLEL PORT	1	1	1	1
HARD DISK/FD. CTRL.	YES	YES	YES	YES
1.2MB 5 1/4" OR 1.44MB 3.5" FD.	YES	YES	YES	YES
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KIDS

By DAISY DEJEAN

So far there are three Carmen Sandiego games: *Where in the World Is Carmen Sandiego?*, *Where in the USA...?*, and *Where in Europe...?*

The games work like this: First, the chief gives you an assignment, and you get a week's time limit. Your job is to find out which criminal committed the crime: the leader, Carmen Sandiego, or one of her band. As you chase him or her from country to country (or state to state), the program gives you clues about the person or the crime.

If you don't understand the clue, then you have to look it up in your atlas (with the Europe game), in *Fodor's USA* (with the USA game), or in the *World Almanac* (with the World game). The book you need is given to you with each game.

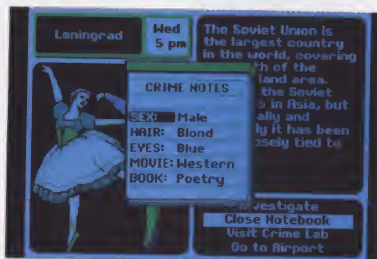
When you catch the thief, you win. But if you don't catch the thief within the time limit, or if you don't get an arrest warrant for the right criminal, you lose.

The thing I don't like about these games is that when I first started playing, I had trouble understanding them. I think that there should be better instructions on how to play.

One good thing is that I'm learning a lot about geography. I think all three Carmen Sandiego games are really good, although my favorite is *Where in Europe...?*, mainly because it gives you better clues and more tools. I suggest you play it. ☒

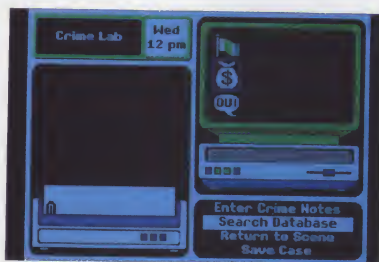
Daisy DeJean, 13, lives in Newton, Massachusetts, in a house full of computers.

She plays Where in the World Is Carmen Sandiego? and a lot of other games on her Apple IIC, and she uses Bank Street Writer to write papers for school. She really wants a Macintosh.



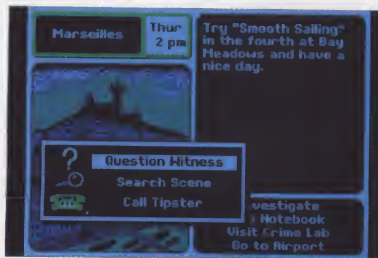
Where in the World Is Carmen Sandiego?

List Price: \$39.95; available for IBM and Apple, including Macintosh.
Requires: 128K for IBM; 64K for Apple; joystick and keyboard.



Where in the USA Is Carmen Sandiego?

List Price: \$44.95; available for IBM and Apple, but not Macintosh.
Requires: 128K for IBM; 64K for Apple; joystick and keyboard.



Where in Europe Is Carmen Sandiego?

List Price: \$44.95; available for IBM and Apple, but not Macintosh.
Requires: 256K for IBM; 128K for Apple; no other special requirements.

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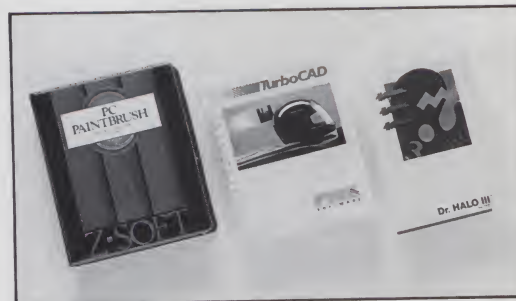


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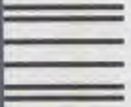
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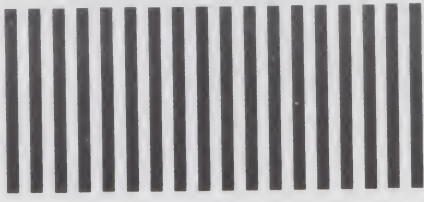
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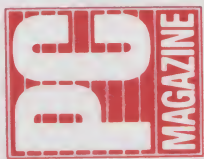


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FUN!

By THOMAS HORNE

Flight simulation software has come a long way from the days when keyboard pilots struggled just to get their planes off the ground. Today simulators are easier to control, more realistic—and much more fun. They also offer a wider range of flying activities, including train-

ing and pleasure flying, as well as air combat.

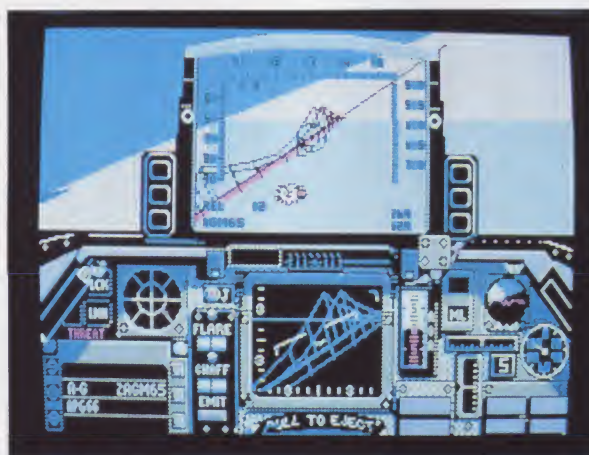
All of the packages reviewed below get high marks. They come with excellent manuals and keyboard-command summary cards, and none of them is copy protected.

Spectrum HoloByte's Falcon

Air-to-air combat isn't everyone's idea of a good time, particularly in these days of superpower summitry. But *Top Gun* fever is still alive and well, and more than a few would-be pilots dream of zipping along at Mach 1.

Falcon was developed with such people in mind. Based on General Dynamics' F-16 fighter, Falcon is not for doves. It equips you with a variety of armaments, including air-to-air and air-to-ground missiles and a machine gun. To begin flying, you commission yourself at one of five military ranks: first lieutenant, captain, major, lieutenant colonel, or colonel. Each successive rank requires more skill. The first-lieutenant level of play is easy: you can't crash, and you can shoot down enemy MiGs with impunity.

As you promote yourself through the ranks, your airplane becomes more difficult to fly, and you experience some of the effects of high-speed air maneuvers. For example, as a major, you can



Falcon's instrument panel and head-up display combine to show you the combat mode, remaining armaments, g-force, and target. Blissfully unaware of the current thaw in superpower relations, Falcon straps you in the cockpit of a fully armed F-16 and sends you off to destroy enemy bridges, airfields, and military bases.

suffer blackouts and redouts by accelerating or decelerating too quickly. The screen lightens or darkens in response to high g-forces, signifying that you have taken a momentary nap in the cockpit.

Falcon offers 12 missions, from the Milk Run, an air-to-ground missile attack, to the Grand Slam, a nerve-racking run requiring you to shoot down four MiGs.

Each mission features a terrific head-up display (HUD). It shows your air speed, heading, altitude, flight-path ladder, armament, and range to target. The instrument panel's map display shows your position with respect to surrounding terrain and provides intercept information when pursuing enemy MiGs. A landing system display can be superimposed on the HUD. Follow the command bars and you should arrive safely at the runway threshold.

The Falcon operator's manual also answers the call of duty, with details on missile-evasion tactics, charac-

FUN!

Chuck Yeager's Advanced Flight Trainer

teristics of the MiG-21, stall recovery, and basic air combat maneuvers. Learn your lessons well and the software will award you ribbons for outstanding skill. It even offers a "black box" that lets you store and replay your best flights.

Falcon is packed with action and intrigue. It's a game that won't get old quickly.

Falcon

List Price: \$49.95

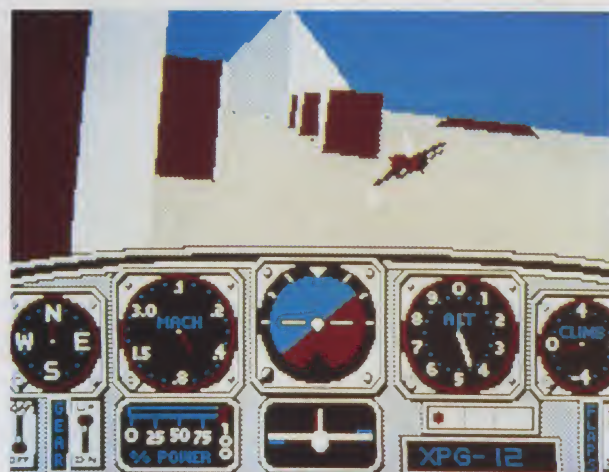
Requires: 256K RAM; CGA or Hercules graphics card. Joystick optional.

Spectrum HoloByte
2061 Challenger Dr.
Alameda, Calif. 94501
(415) 522-3584

Who wouldn't accept an offer for flight lessons from Chuck Yeager, test pilot extraordinaire? Advanced Flight Trainer offers arm-chair aviators just such a chance. To keep at-home flight students from feeling too smug, though, AFT offers an onscreen image of Yeager's growling face, along with such criticisms as "You call yourself a pilot?"

AFT's test flight mode introduces you to the instruments and controls, then turns you loose to practice the mundane but necessary exercises that all pilots must master, such as power-on and power-off stalls. When starting out, be sure to choose a docile plane, like a Piper Cherokee or a Cessna 172. I began with a North American P-51 Mustang, lifted off too soon on the takeoff roll, stalled, and promptly crashed in the desert. In the aftermath, Yeager's face appeared on the screen with the admonishment "You just dug a hole halfway to China." Thanks, Chuck.

Other test flight tasks give the pilot a feel for the capabilities of each of the pro-



AFT's cockpit control panel details your position, speed, and altitude. High-speed obstacle courses test your agility in avoiding pyramids, pylons, and a road flanked by tall buildings.

gram's 14 airplanes, from a World War I Spad XIII to a Lockheed SR-71 Mach 3 spy plane. For example, you can learn each airplane's maximum altitude and climb rate as well as its minimum takeoff and cruising speeds.

The program also includes several obstacle courses, consisting of pylons, pyramids, gates, and a road flanked by tall buildings. Flying through and around these obstacles gives you a feel for each airplane's maneuverability. It also illustrates why you shouldn't attempt such stunts in a real airplane.

AFT's most impressive feature is its smooth manner of coaxing users through the fundamentals. You get a surprisingly realistic taste of aeronautics, covering everything from preflight check to takeoff, climbs, turns, level flight, descent, and landing. The instrument panel is simple but approximates what you'd see in a real training plane. The user's manual is an accurate, readable guide to flying basics, though it's a bit sketchy.

You'll like Yeager's AFT, wisecracks and all. It's educational, not too demanding, and versatile.

Acerbic comments from flying ace Chuck Yeager are an integral part of Advanced Flight Trainer. The master guides you through test flights of the program's 14 aircraft and also instructs you in the basics of flying.

Chuck Yeager's Advanced Flight Trainer

List Price: \$39.95

Requires: 256K RAM; CGA, EGA, or Hercules graphics card; DOS 2.0 or later. Joystick optional.
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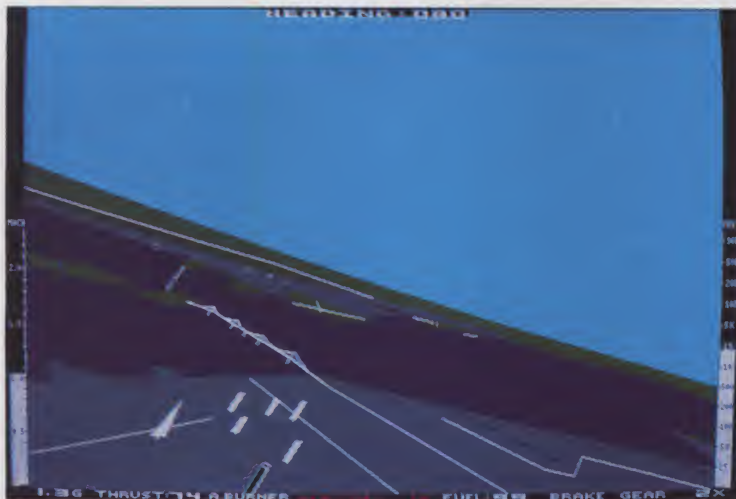
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SubLogic's Jet

Inset one of Jet's scenery diskettes and you can barnstorm over such faraway places as England, France, and West Germany, floating leisurely over their well-known landmarks. Looking for something a little closer to home? The diskette for the United States lets you soar from coast to coast, taking in the sights from Washington, D.C., to San Francisco.

In addition to its spectacular free-flight mode, Jet has modes for dogfight and target strike. For aircraft, you get a choice of a ground-based F-16 or a carrier-based F-18. The enemy flies MiG-21s or MiG-23s, depending on the level of difficulty you select. Your armament includes air-to-air and air-to-ground missiles, plus a machine gun for more intimate encounters.

Jet is more sensitive to pitch (nose-up and nose-down movements) than Falcon and AFT. Like AFT,

Jet offers armchair pilots temporary escape to far-off places in Europe and the United States. The program's scenery diskettes let you drift casually over continents and landmarks—without the long terminals and lost baggage associated with more conventional means of air transportation.

though, Jet lets you view from either the cockpit or the control tower. I found the latter vantage helpful in correcting the wildest pitch excursions and great fun after ejecting: you can watch yourself parachute to earth.

Jet is by far the most difficult and awkward of these simulators to use—and ultimately the most disappointing. Much of its trouble stems from its screen display and lack of an instrument panel. Jet has a HUD, but it's quite different from Falcon's. Its large flight ladder helps in attitude orientation, but its efficacy is diminished by the ladder's size and the expansive view; it winds up being downright disorienting. Flight and engine data are relegated to the periphery of the display and are too small to read quickly and accurately.

In combat mode, Jet becomes even more cumbersome. It lacks the sophisticated sighting controls of

Falcon and offers only a miniature radar screen and a simple sight.

More laid back than Falcon, more intense than AFT, Jet is best suited to those who want to free-fly over the earth just for the fun of it. Jet has weaknesses, but the scenery compensates for them.

Jet

List Price: \$49.95

Requires: 256K RAM; CGA, EGA or Hercules graphics card. Joystick optional.

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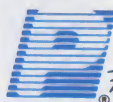
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FUN!

Microsoft's Flight Simulator

Although it doesn't offer you the sheer excitement of flying an F-16, Flight Simulator Version 3 is without doubt the most realistic PC flight simulation program available.

The program now supports EGA and VGA displays in several modes and offers a second airplane, loads of scenery, flight training, and programmable weather. In addition, the manual contains excellent instructions for novices.

Like its predecessors, Version 3 starts you off in the

cockpit of a Cessna at Meigs Field in Chicago. But there the similarity ends. The most striking difference is the display: Flight Simulator now makes full use of graphics hardware. It offers the best view of any of these simulators, featuring clouds, buildings, storms, and, for night flying, stars.

Beginners will find three levels of flying lessons. The exercises range from basic maneuvers, including taxiing, to complex aerobatics, including Immelmann and Hammerhead turns as well

as power-on and power-off stalls. The manual describes each technique thoroughly. You have to keep it handy, though, because there is no supplementary information on the screen.

For excitement, Version 3 lets you trade in your Cessna for a twin-turbojet Gates Learjet and cruise the skies at speeds approaching Mach 1. You don't get heat-seeking missiles or a HUD, but flying the Lear provides an interesting contrast in aircraft behavior. The luxury jet is heavier and slower to respond than a fighter and has different handling characteristics.

Flight Simulator still offers the World War I dogfight, a fun but limited air-strike game, as well as crop dusting and formation flying.

But make no mistake: this

is not a shoot-'em-up game but a serious attempt to simulate flying. And with its excellent graphics and manual, it succeeds. ■

Thomas Horne has been a pilot and flight instructor for 15 years. He lives in Bethesda, Maryland.

Flight Simulator

List Price: \$49.95

Requires: 256K RAM; CGA, EGA, or Hercules graphics card. Joystick optional.

Microsoft Corp.
16011 NE 36th Way
Box 97017
Redmond, Wash. 98073
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Microsoft's Flight Simulator Version 3 lets you take a chase-plane view of your aircraft. Details like shadows and depth are crystal clear on EGA/VGA-equipped systems.



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HELP!

Edited by PRESTON GRALLA



I recently decided to upgrade the memory in my 8088-based IBM compatible from 256K to 640K. Wanting to do it myself, I was immediately confronted with a number of questions. First, does it matter whether I buy 64K or 256K chips? Also, should I be concerned with their rated access times?

**Larry Wier
St. Bonaventure, New York**



You should indeed factor the size and speed of the memory chips into your decision.

If you're shopping for a memory expansion card that already has RAM chips on it, you need only consider the chips' rated access times. But if you're plugging chips into empty sockets, you'll need to consider the capacity of the chips as well.

In all cases, the rated access times of the chips must be matched to your PC's memory subsystem. Your technical reference manual should spell out the maximum access time you can safely use, based on the clock speed of the system and the number of wait states imposed by hardware on memory accesses. You can install chips with access times equal to or less than the recommended maximum. Be aware, however, that faster chips will not increase system performance; the speed with which the CPU can read or write to memory will still be constrained by its own clock speed and the number of wait states.

If you're adding chips to empty sockets, you must also consider the chips'

size. Unless you have one of the very early PCs, whose memory subsystems were designed around 16K DRAM (dynamic RAM) modules, the chip sockets on your system board will probably accept either 64K or 256K chips. Again, you'll have to consult the technical documentation for your machine to determine for which size your system was designed. Don't rely on your eyeball, because the pinouts for the 64K and 256K chips and the footprints of the sockets designed to accept them are identical.

Some systems will accept both the 64K and the 256K variety. Usually a dip switch or jumper is set to denote the type of chip installed. And it's not uncommon now for boards to accept denser 1 megabit chips. If you're adding chips to a card rather than to a system board, check the documentation that accompanied the card to determine what type of chip to buy.



What are the basic differences between CGA, EGA, and VGA video adapters? Does the type of adapter I install in my system affect the graphics screen dumps I obtain using the DOS Graphics command?

**David B. Shipman
Boise, Idaho**



The primary differences between the adapters you mention—the Color Graphics Adapter (CGA), the Enhanced Graphics Adapter (EGA), and the Video Graphics Array (VGA)—lie

in the various levels of graphics resolution and number of colors they support.

The CGA was the first color video adapter, introduced by IBM in 1981. It supports seven video modes: two 40-character text modes, two 80-character text modes, and three graphics modes. Two of the graphics modes offer 320-by-200-pixel resolution with four colors, while the third offers 640 by 200 with two colors. In contrast, IBM's Monochrome Display Adapter, sometimes referred to as the MDA, supports only one mode: an 80-character text.

The EGA, which became available early in 1985, is the next step up in graphics sophistication. Connected to an RGB color monitor, it supports all seven CGA modes, plus four additional graphics modes with resolutions up to 640 by 350, and it can simultaneously display up to 16 colors from a palette of 64.

An EGA can drive a monochrome as well as a color display. Configured for monochrome use, it offers the same 80-column text mode found on the MDA, as well as a single 640-by-350 graphics mode. Most software that runs on either a CGA or MDA will run on an EGA, since the later-model adapter was designed to be nearly register-compatible with its predecessors.

Offering even higher resolutions and more colors than the EGA is the VGA. The first VGAs were integrated into the system boards of the high-end IBM PS/2 machines. The VGA supports all of the CGA, MDA, and EGA video modes and adds three new ones of its own, including a 640-by-480 graphics mode that can display 16 colors simultaneously from a palette of more than 262 million. A close cousin of the VGA, the MCGA (Multi-Color Graphics Array), gives some VGA video capabilities to IBM's Models 25 and 30.

The availability of inexpensive clones has made the Enhanced Graph-

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PC-2

HELP!

ics Adapter the de facto minimum standard for PC graphics. In contrast to a CGA, which displays text in a fuzzy 8-by-8-character matrix, an EGA produces text-mode characters with a crispness comparable to that once obtainable only with monochrome systems. The VGA offers even crisper text.

The bad news is that the DOS Graphics command (actually a memory-resident utility that monitors the PrtSc key and dumps graphics screens to IBM-compatible dot matrix printers) has never been updated to support higher-resolution EGA or VGA graphics modes. It supports only the meager 200-line CGA graphics resolutions. Dumping graphics screens of higher pixel densities requires special utility programs.



Does DOS provide an easy way to find out where on my hard disk a given file is stored, short of manually searching each and every directory?

Brian L. Hinman
Beverly, Massachusetts



Yes, by making use of a feature of CHKDSK combined with a DOS filter called Find.exe. To locate a file called Sample.doc, for example, type:

CHKDSK/V\FIND "SAMPLE.DOC"

If the current drive is C and DOS finds the file in the subdirectory \WPT\TXT, it will respond with:

C:\WPT\TXT\SAMPLE.DOC

Note that DOS must be able to locate the external commands CHKDSK and Find or it will simply answer, "Bad command or file name". Use the Path command for this. (See this month's DOS column for a full explanation of how to use Path.)

One limitation of using CHKDSK for searching is that you cannot do searches with the wildcard characters * and ?. This is one reason to consider using any of a number of public domain utilities designed specifically for this purpose. Most of them allow you to embed * and

? in the search string.

Keep in mind that the filename enclosed in quotation marks must be capitalized or the search will not work.



I've made a habit of putting often used sequences of commands into batch files so I can execute them automatically. When I include a program or command that interrupts the batch program by pausing for input from the console (usually wanting me to press Y for Yes or N for No before proceeding), I create a simple text file with the correct response. Then I use DOS's ability to redirect standard input, and I have the correct response automatically given at the proper time. In this way, the batch file keeps going even if I'm away from my computer.

This trick doesn't work with all programs, however. Why does redirecting input from a file to a program work with some programs and not with others?

Sandra Deogracias
Cincinnati, Ohio

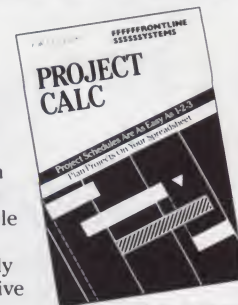


Redirection of standard input—sending input to a program from a disk file rather than from the keyboard—is one of the handiest features DOS has to offer. A simple example can be shown with the Del command. If you type "Del *.*" at the command prompt to delete the contents of a diskette or a directory, DOS asks, "Are you sure (Y/N)?" before it carries out the order. But you can take advantage of redirection to execute the command without having to answer the question.

First, use any text editor to create a one-line file (call it Answer.txt) that simply contains the character Y. Be sure to press Enter after typing it so that a carriage return will be included. Save the file. Then, if you were to type Del

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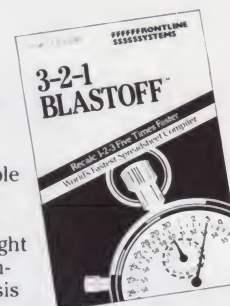
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HELP!

. <Answer.txt, DOS would execute the Del command, Del would read the contents of the file Answer.txt and accept the Y as your answer, and all files would be erased. Important: Don't try this in a directory where valuable data are stored.

Whether input redirection (a feature implemented at the DOS level) works depends on how the program gets its input from the keyboard. Programs generally solicit keystrokes in one of two ways: by calling a BIOS routine contained in ROM or by invoking an operating system function that in turn calls the BIOS routine. Simply put, input can be redirected if the operating system call is used; it can't if the program goes directly to the BIOS.

R

Reader's Tip: Upon upgrading to DOS 3.30, I discovered a new command named Xcopy that greatly speeds up file copying and enables the easy backup of hard disk directories containing more than 360K without having to resort to the Backup command. Xcopy cuts down on the number of read/write cycles normally required by the Copy command. And like Copy, Xcopy stores files in their native format so that they are usable without running the DOS Restore utility required by the Backup command.

To copy the contents of a hard disk directory onto a diskette with Xcopy, use the following three-step procedure:

(1) Mark the contents of the directory to be copied using the DOS Attrib command with the +A (for "archive") attribute:

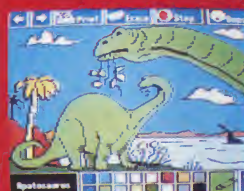
```
ATTRIB +A *.*
```

(2) Use Xcopy with the /M switch to copy the files to the diskette.

```
XCOPY *.* A: /M
```

The /M switch tells DOS to copy only those files which have been modified.

(3) If more than one diskette is required to hold all of the targeted files, Xcopy will respond with the message "Insufficient disk space" after each diskette is filled; at this point, only the files not yet copied will still be marked with the +A attribute. Simply place a new diskette in the drive and repeat the Xcopy command until all files are transferred.



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HELP!

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Robert Russo
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You're right on target with the Xcopy command and how convenient it makes backing up hard disk data.

Xcopy first appeared in DOS 3.20. Two of the primary advantages it offers over the Copy command are that it will use any and all available memory (not just a single 64K block) and that it will perform wildcard copies with as many files as will fit into memory (not just one file at a time). If you transfer 20 files from one floppy disk to another in a single-drive system with a Copy *.* command, DOS will force you to swap diskettes 20 times. But do the same with Xcopy, and DOS will read as many files into RAM as it can, write them to the target diskette, and return for more if it can't swallow them all in one bite. Disk accesses are drastically reduced and speed is increased.

But Xcopy has even more to offer. Run it with a /E or /S parameter on the command line and it will copy every file in the specified directory, as well as every one in any subdirectories stemming from that directory. It even copies the subdirectories themselves. The /D switch permits you to copy only those files stamped with a date later than the one specified. And /P coerces Xcopy to operate on a file-by-file basis, prompting you for permission to proceed before copying each new file.

Xcopy alone is reason enough for most users to upgrade to DOS 3.30. Once you use it, you won't want to live without it—especially if, like many, you opted to buy only a single diskette drive when you decided to equip your system with a hard disk.



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HOW TO AVOID THE CONFUSIONS IN PERSONAL COMPUTING

When the big giants designed the Personal Computer and the Disk Operating System that makes your PC do what it's suppose to do, they forgot one **IMPORTANT** thing:- To remove the thorny and messy confusion out of DOS and MS-DOS commands.

Instead the giants and their clone manufacturers did one thing; provide PC users like you with big volume of manuals that takes days to read and forever to understand and use many confusing commands in these manuals. This is the reason you are getting the headache you have with your Personal Computer or PS/2 or compatible.

What is the solution?

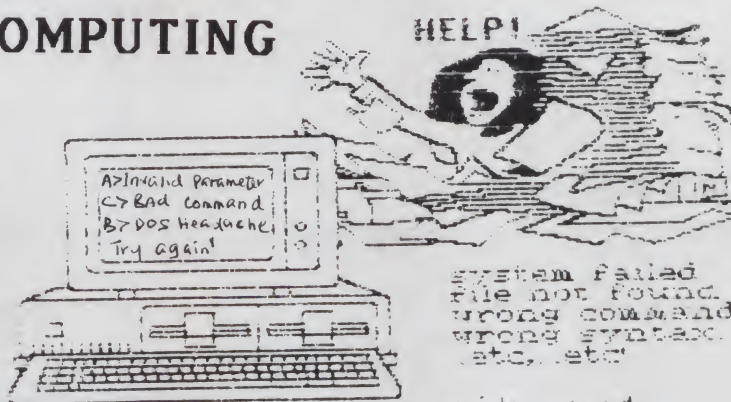
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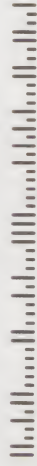
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NEXT

By ISAAC ASIMOV

The chief consequence of the computer revolution is that humans are being relieved of the dull and stultifying labor to which they have been subjected for all of history. Until this present generation, there have always been myriad tasks that required too much intelligence for anything but a human being to do—yet required far less intelligence than the human brain was capable of delivering.

The result was that most human beings earned their livings in ways that seriously underused their brains and gradually atrophied them. If, for years, a person has no occasion to indulge in creative thought, one cannot expect that person to be creative on demand.

That is why the proliferation of computers (and robots, which after all are merely computerized machines) may create a crisis as jobs inevitably disappear. Those who lose their jobs to computers cannot easily obtain other, more creative jobs, for they have seldom been called upon to be creative before. Society will have to engage in large-scale retraining, reeducation, welfare, and make-work projects.

However, the disappearance of menial labor will make it possible for human beings to switch to more appropriate work—the kind of work that cannot be done by computers, whose abilities may never match the complexity and versatility of the human brain, with its billions of cell-units, each enormously complex in itself and all arranged in intricate combinations. After relatively few years of reeducation, then, a new generation will arise that will be trained from the start for new kinds of work—far

more humanly creative work.

This may seem hopelessly idealistic to those who feel that creativity, although a human attribute, is the province of only a fortunate few, while the vast majority of human beings simply don't and can't possess creativity.

This seems to me a misreading of human capacity brought about by ignoring the existence of a vicious cycle. We have always had a social system that condemned virtually all human beings to the underuse and atrophy of the brain, and we have surveyed the broken results and used them to support the thesis that, with some exceptions, human beings are brainless.

If computers rescue human beings from brain-destroying work, and if we then proceed to develop new and revolutionary forms of education, we may discover that creativity is a common

human trait and that the intellectual, artistic, and intuitive abilities of humanity will make an enormous leap.

This may seem impossible to achieve, but humanity accomplished something of this sort earlier in its history. For all the centuries before the Industrial Rev-

We have a social system that condemns virtually all humans to atrophy of the brain.

olution, literacy was the province of a very few. It was easy to suppose that most people simply lacked the mental equipment to learn how to encode words readily and easily into the intricate symbols of writing, and how to decode them just as readily and easily once written.

And yet when the Industrial Revolution came and people had to deal with new and complex machinery, mass literacy became necessary. For that reason, education was revolutionized, free public schools were organized, and youngsters were *forced* to attend. And behold! We discovered that most human beings could be taught to read and write after all.

But how can education be revolutionized in such a way that people can learn to be creative? How do you teach creativity?

Creativity does not have to be taught: it already exists in the normal human brain. But it seems to me that the present form of education, far from simply failing to teach creativity, actually brings about the destruction of the creativity



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NEXT

that is already there.

This is not done deliberately. I'm not talking of villains. It's just that the only way of bringing about mass education in a noncomputerized society is to teach children in large groups according to the dictates of a uniform curriculum—to teach them the same things at the same time in the same manner. And yet every child is an individual with interests and curiosities of his own. What better way to squelch a child and turn

**We may discover
that creativity is a
common human trait.**

him forever against the delights of learning than by introducing him to a system of learning that denies him his individuality?

However, the very computers that will remove scut work from the world can also transfer enormous libraries into their memories. The complex and versatile computers of the future will therefore have the capacity to be teaching machines of satisfying complexity.

We can imagine outlets in every home, so that people young and old can ask for information: books, pamphlets, technical directions, art, music. The products of thousands of years of human culture and knowledge will be readily available. The computer can locate answers to questions, can suggest further directions for research.

This will not lead to the demise of schools. Schools are places where certain basics can be taught, and where more important, person-to-person interactions can take place. There, youngsters will learn how to use computer outlets properly.

Mind you, I am not suggesting that the computer be merely another school tool, a fancier kind of pen-and-paper, a more elaborate textbook. A computer that is tied to school becomes merely part of the curriculum. It may be a convenience, but it won't be a revolution.

No, it is of the essence that a computer and a human being be untrammelled in their relationship; that the person who wishes information, however trivial or "unimportant," can indulge that wish in his own way, in his own

place, at his own time; that he can switch interests without warning, drop certain subjects, pick up others; in short, that he can experience the ecstasy of learning. Give the owners of brains a chance to learn *in their own way, not necessarily in yours*, and they will love it. They may unleash their inherent creativity in the process.

And that is exactly what computers will allow them to do.

But then, to those who look into the future, it may seem that as computers advance and gain more capacity, they will take over more and more jobs we consider human and creative and thus render us obsolete.

I don't think so. Automobiles can go much faster than feet can go, but feet have not been rendered obsolete for the purpose of traveling. In the same way, even if the computer apes "intelligence," it is not necessarily the *same* intelligence we have. I am writing this essay on a word processor, but unless I strike the proper keys, it can't do a thing. Nor can I ever expect to be able to program a word processor to make up its own essay by telling it exactly which word to choose next and how to organize the essay as a whole.

I can't program a computer to do this because I don't know how *I* do it. The essence of human creativity in every field is that we don't really know how we create; we just do it. We can retain that nonunderstood ability—and we can leave it to the computer to do those jobs so simple that they can be analyzed and taught to a machine.

In that way, human beings won't be competing with computers; we'll be *co-operating* with them. The cooperation of two kinds of intelligence will make person/computer a far more powerful agency for understanding the universe than either alone would be.

And even as we continually improve and sharpen the computer's abilities, so we can use the computer more effectively to sharpen our own abilities and continually heighten our creative faculties.

The future might then prove a marvelous one. □

Born in the USSR and reared in Brooklyn, Isaac Asimov sold his first story at 18. At last count, he has published over 340 books on all subjects.

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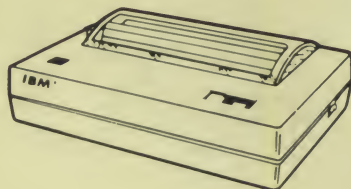
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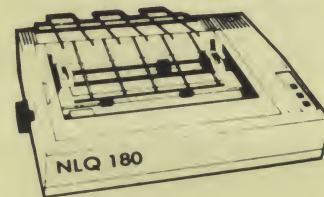
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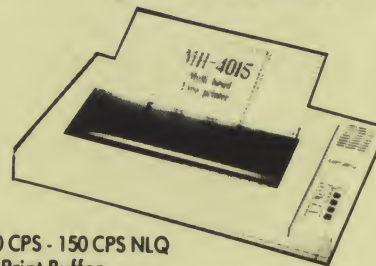
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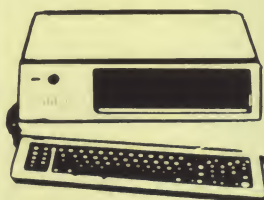


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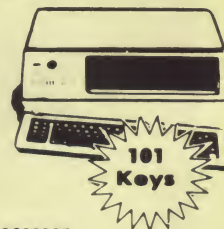
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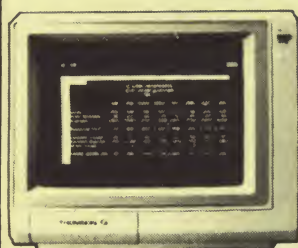
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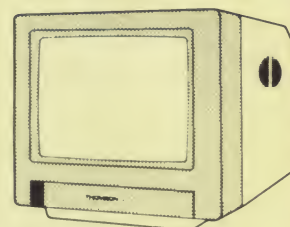
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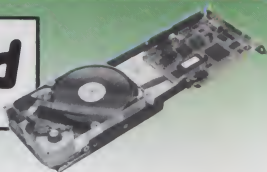
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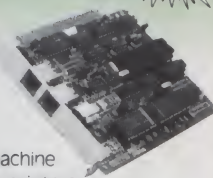
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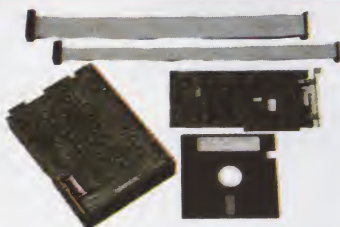
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FALL





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- Eight expansion slots
- Clock/calendar with battery backup
- Choice of AT-style, 5151, or enhanced 101-key keyboard

Monitor - A high-resolution amber monochrome monitor with 12" display and monographics card with parallel port. For a sharper image, try our EGA or VGA color video option. See chart.

Hard Drive - 20MB hard drive fully installed. Includes free PC-FullBak backup software. For upgrade, see chart.

Printer - Epson LX-800 provides software compatibility, plus 180cps draft and 30cps NLQ printing, multiple type styles, Epson Character Graphics set, dot-graphics capability and tractor/friction paper feed.

Software - You'll appreciate Professional Zen. This totally integrated software package includes ZenWord, ZenCalc, and ZenLink for all of your word processing, spreadsheet, and communications needs. MS-DOS and GW Basic software complete your system.

Accessories - 200 sheets of continuous form paper, a printer cable, and ten blank floppies get you started.

63725 - **\$1515**

Professional Starter Kit Options			
	Monographics	EGA	VGA
20MB	63725	63726	63724
	\$1515	\$1915	\$2065
40MB	63730	63731	63732
	\$1640	\$2040	\$2190
60MB	63735	63736	63737
	\$1700	\$2100	\$2250



12MHz Advanced Starter Kit™

The Standard-286/12™, AT-compatible computer with:

- 6MHz and 12MHz switchable speeds
- 0 wait states
- 80286 processor
- 1MB RAM
- 1.2MB floppy drive
- Dual floppy/hard drive controller
- 200-watt power supply
- Math coprocessor socket
- Eight expansion slots
- Clock/calendar with battery backup
- Choice of AT-style, 5151, or enhanced 101-key keyboard

Monitor - A high-resolution amber monochrome monitor with 12" display and monographics card with parallel port. For a sharper image, try our EGA or VGA Color video option. See chart.

Hard Drive - 20MB hard drive, fully installed. Includes PC-FullBak backup software. For upgrades, see chart.

Printer - Epson LX-800 provides software compatibility, plus 180cps draft and 30cps near letter quality printing, multiple type styles, Epson Character Graphics set, dot-graphics capability and tractor/friction paper feed.

Software - You'll appreciate Professional Zen. This totally integrated software package includes ZenWord, ZenCalc, and ZenLink for all of your word processing, spreadsheet, and communications needs. MS-DOS and GW Basic software complete your system.

Accessories - 200 sheets of continuous form paper, a printer cable, and ten blank floppies get you started.

63750 - **\$1715**

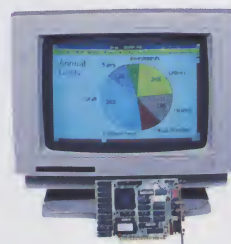
Advanced Starter Kit Options			
	Monographics	EGA	VGA
20MB	63750 \$1715	63751 \$2115	63752 \$2285
40MB	63755 \$1840	63756 \$2240	63757 \$2390
60MB	63760 \$1900	63761 \$2300	63762 \$2450

Video options

Flatscreen

Monographics Combo

This basic, dependable video package is standard equipment on all our starter kits. It includes a Samsung™ monitor with a 12" flat screen and tilt swivel base for easy viewing. The 80-character amber display offers high contrast and high resolution. The monochrome graphics card provides text display of 80 columns by 25 lines or graphics display of 720 columns by 348 addressable dots. It includes a parallel port.

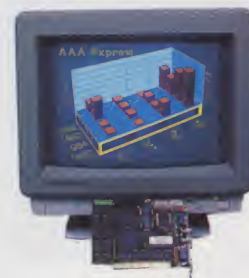


Enhanced Graphics Adapter (EGA) Video Option Package

Upgrade your kit with enhanced color graphics. The EGA option package includes an EGA monitor with industry standard 14" tube size (13" diagonal) screen. The .31mm dot pitch provides a high-resolution display. The EGA video card has a 256KB display memory and a high-resolution (640x350) graphics mode. It displays 16 out of a possible 64 colors at a time.

Video Graphics Adapter (VGA) Video Option Package

Get the most from your chosen computer kit with the finest color graphics of available technology. The VGA option package includes a color VGA analog monitor. The 14" screen displays a spectrum of colors and offers a .28mm dot pitch and 31.5KHz horizontal scan frequency. The VGA video card supports high resolution (800x600) graphics and displays 16 out of a possible 256 colors at a time.



Everything you need to begin computing immediately!

For more information call **CompuAdd:**

1-800-627-1967

Our convenient coast-to-coast hours are 8 a.m. - 9 p.m. CST Monday through Friday and 9 a.m. - 5 p.m. CST on Saturday.

Standard-386/16™

Featuring:

- 4.77MHz, 6MHz, 8MHz, and 16MHz software-selectable speeds
- 1MB RAM expandable to 4MB (supports up to 10MB RAM on expansion boards)
- Clock/calendar with battery backup
- Five 16-bit expansion slots
- Two 8-bit expansion slots
- 200-watt power supply
- 1.2MB floppy drive
- Dual floppy/hard drive controller
- Math coprocessor socket for the 80287 or 80387
- Your choice of enhanced 101-key, AT-style, or 5151 keyboard
- 17.6 on Norton's SI Benchmark 4.0 test

The BIOS can be relocated into high speed RAM for increased system throughput.

63250 - \$2095

Standard-286/12™

Featuring:

- 6MHz and 12MHz switchable speeds.
- 0 wait states
- 1MB RAM
- Clock-calendar with battery backup
- Six 16-bit expansion slots
- Two 8-bit expansion slots
- 200-watt power supply
- 1.2MB floppy drive
- Dual floppy/hard drive controller
- Math coprocessor socket
- Your choice of enhanced 101-key, AT-style, or 5151 keyboard
- 13.7 on Norton's SI Benchmark 4.0 test

"We found the Standard Brand-286/12 to be a fast and versatile AT-compatible."

Computer Buyer's Guide and Handbook, Volume V, Issue 5

63177 - \$1245



Monitors optional.

Standard-286/10™

Featuring:

- 6MHz and 10MHz switchable speeds
- 512KB RAM expandable to 1MB
- Clock/calendar with battery backup
- Six 16-bit expansion slots
- Two 8-bit expansion slots
- 200-watt power supply
- 1.2MB floppy drive
- Dual floppy/hard drive controller
- Math coprocessor socket
- Your choice of enhanced 101-key, AT-style, or 5151 keyboard
- 9.4 on Norton's SI Benchmark 4.0 test

63150 - \$1045

"Overall, the Standard-286/10 appears to be one of the most attractive values... It comes with a good complement of manuals and software and performs precisely as you would expect. You should be happy with this one."

Alfred Poor—
PC Magazine



Editor's
Choice
Feb 16, 1988

Standard Turbo/10™

PC/XT®-Compatible Computer™

Featuring:

- 4.77MHz and 10MHz switchable speeds
- 8088 processor
- 640KB RAM
- Math coprocessor socket
- Eight expansion slots
- 360KB floppy drive
- 150-watt power supply
- Your choice of enhanced 101-key, AT-style, or 5151 keyboard

63050 - \$595



Monitors optional.

Mass storage with mass appeal for AT[®] compatibles.

Hard drives for AT compatibles include: drive, data cable, mounting hardware, manual, and **free** PC-FullBak[®] disk backup software. Hard drives above 30MB come with partitioning software.



Maxtor 338MB full-height ESDI hard drive for the 286/386 with an access time of 16ms. Uses 1:1 interleave and has a 10MBit per second data transfer rate. Includes dual floppy/dual hard drive controller. 47451 - \$2575

CDC 150MB full-height ESDI hard drive for the 286/386 with an access time of 18ms. Uses 1:1 interleave and has a 10MBit per second data transfer rate. Includes dual floppy/dual hard drive controller. 47431 - \$1599

MiniScribe[®] 110MB full-height hard drive for the AT with an access time of 28ms. Uses RLL encoding, 1:1 interleave, and has a 7.5MBit per second data transfer rate. RLL controller card included. 47425 - \$895



MiniScribe 44MB half-height hard drive for the AT with an access time of 25ms. 47204 - \$459



Seagate[®] 80MB full-height hard drive for the AT with an access time of 28ms. 47401 - \$695



Seagate 40MB half-height hard drive for the AT with an access time of 28ms. 47207 - \$439

MiniScribe 71MB full-height hard drive for the AT with an access time of 28ms. 47400 - \$649

Seagate 20MB half-height hard drive for the AT with an access time of 65ms. 47003 - \$249

Floppy drives

Floppy drives allow you to store information on removable and portable diskettes.

360KB half-height floppy drive for the PC/XT (black). 45304 - \$99

360KB Teac[®] floppy drive for the PC/XT (black). 45301 - \$109

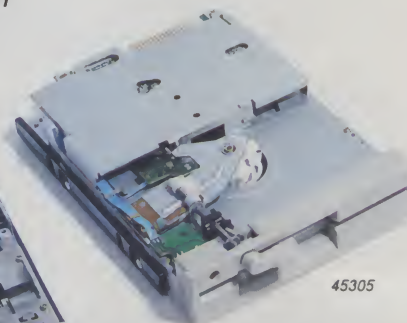
720KB half-height 3.5" floppy drive for the PC/XT (black). 45205 - \$109

360KB half-height floppy drive for the AT (grey). 45305 - \$109

360KB Teac floppy drive for the AT (grey). 45303 - \$109

720KB half-height 3.5" floppy drive (grey). 45204 - \$115

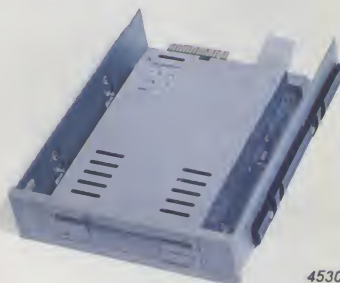
45351



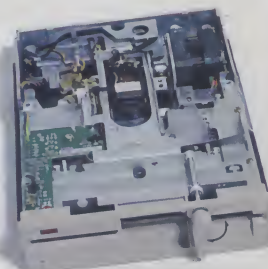
1.2MB floppy drive for the AT (grey). 45352 - \$109

1.2MB Teac floppy drive for the AT (grey). 45351 - \$119

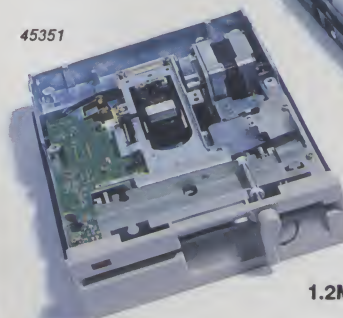
1.44MB Panasonic[®] half-height floppy drive (grey). 45220 - \$135



45204



45303



Personal System/2[™] - compatible external drive installs as drive B and permits transfer from 360KB to 720KB format. 62554 - \$269

PC/XT-compatible hard drives are easy on the wallet.

Hard drive kits for PC/XT compatibles include: drive, cables, mounting hardware, controller card, complete manual, and **free** PC-FullBak® disk backup software.

MiniScribe 20MB half-height hard drive for the PC/XT with an access time of 65ms.

47001 - \$279

Seagate 20MB half-height hard drive for the PC/XT with an access time of 65ms.

47002 - \$289

MiniScribe 30MB half-height hard drive for the PC/XT with an access time of 65ms.

47100 - \$339

Seagate 30MB half-height hard drive for the PC/XT with an access time of 65ms.

47101 - \$310

MiniScribe 40MB half-height hard drive for the PC/XT with an access time of 61ms.

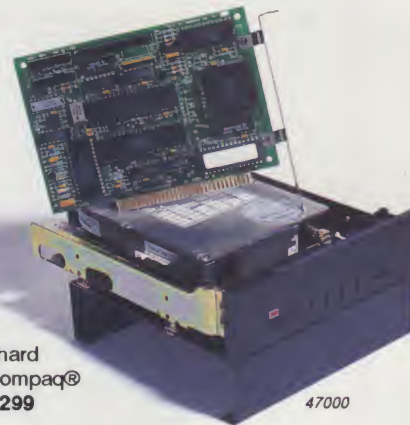
47206 - \$379

MiniScribe 60MB half-height hard drive for the PC/XT with an access time of 61ms. Has RLL encoding, 4:1 interleave,

and 7.5MBit per second data transfer rate. RLL controller card included.

47250 - \$419

20MB 3.5" half-height hard drive kit suitable for Compaq® portables. 47000 - \$299



The FlashCard-20 and FlashCard-30 were PC Magazine Editor's Choice. February 20, 1987.



STRIKE it rich with the FlashCard-49!™

Uncover the FlashCard-49; you'll discover a mother lode of high-capacity, high-speed mass storage mounted on a bracket with controller for quick, trouble-free installation.

FlashCard-49, 49MB Seagate, 28ms. 47208 - \$539

FlashCard-30™, 30MB MiniScribe, 65ms. 47104 - \$339

FlashCard-20™, 20MB MiniScribe, 65ms. 47005 - \$319

Free PC-FullBak software with every hard drive purchase—exclusively from CompuAdd.
1-800-627-1967

SPECIAL!

Computer service kits

Computer service kits are handy versatile kits that keep all the necessary tools for maintaining your computer right at your fingertips.

Basic Tool Kit includes chip inserter, extractor, 3-claw holder, tweezers, four screwdrivers, four nutdrivers, and torque screwdriver in a vinyl case. 41131 - \$9.95 (Reg. \$14)
Soldering Tool Kit includes chip inserter, extractor, anti-static wrist strap, coiled ground cord, soldering iron, desolder-

ing tool, solder tools, pliers, and clippers in a vinyl case. 41132 - \$35

Advanced Tool Kit includes chip inserter, chip and square chip extractors, anti-static wrist strap, multiple screwdriver with six extensions, two nutdrivers, and two torque screwdrivers in a vinyl case. 41133 - \$39

Troubleshooting Tool Kit includes chip inserter, chip and square chip extractors, anti-static wrist strap, multiple screwdriver with six extensions, two nutdrivers, two torque screwdrivers, a logic probe, a logic pulser, and a 3-piece tweezer set in a vinyl case. 41134 - \$89



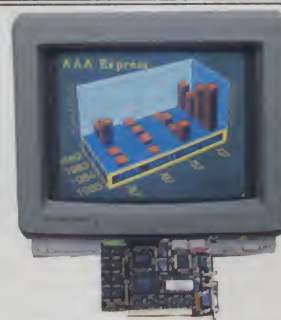
Video combos



Flatscreen Monographics Combo
Includes Samsung 12" flat screen monitor with tilt and swivel base, and monographics video card. 51700 - \$139



Color Graphics Adapter (CGA) Combo
Includes 12" color monitor and color card. 51701 - \$289



Enhanced Graphics Adapter (EGA) Combo
Includes a 14" industry-standard tube with 13" diagonal EGA monitor and CGA-350 card. 51702 - \$489

Monochrome

Amber and black-and-white — perfect start-up video for comfortable viewing and low price.

Samsung 12" monitor, curved screen amber monochrome monitor. 51000 - \$89



51000

Amdek® 410W monitor, black and white display with 12" flat screen. 51006 - \$159



51006

CompuAdd - your source for computers, peripherals, software, and office products
1-800-627-1967

Samsung™ 12" monitor, flat screen amber monochrome with high-contrast, non-glare screen, high resolution, 80 or 40 character display, and tilt/swivel base. 51001 - \$95

Hercules™ Monochrome Graphics Card Plus, monochrome display with high-resolution graphics (up to 720x348) and text display. Includes parallel port. 48350 - \$179



48350

Monographics card is a high-resolution monochrome graphics (up to 720x348) card. Includes parallel port. 48301 - \$53



48301

Color

IBM-compatible color monitor with 12" screen. 51100 - \$239



51101

Princeton® HX-12+ color monitor with .28mm dot pitch, 77x200 line resolution, and 18MHz bandwidth. 51101 - \$349

Hercules Color Graphics card has color graphics and printer port for the AT/PC on a space-saving half-size card. 48351 - \$149

Color graphics card is a high-resolution color graphics adapter that operates in both color and composite mode. Includes a parallel port. 48302 - \$53



48302

EGA

EGA... the standard for high-resolution color.

IBM-compatible 14" EGA monitor offers the best value in an enhanced color monitor. Its industry standard 14" tube with 13" (diagonal) screen offers .31mm dot pitch and high resolution. 51201 - \$349

NEC Multisync® II adjusts to any horizontal synchronization frequency between 15.5KHz and 31.7KHz. It supports TTL and analog inputs and resolutions of up to 800x675. The 14" display has a 30MHz bandwidth and .31mm dot pitch. 51202 - \$679

Video-7 Vega Deluxe™ EGA card supports EGA, CGA, and monographics displays. Capable of high resolution up to 640x380 (752x410 with NEC MultiSync II or other compatible monitors). 48376 - \$229

48376

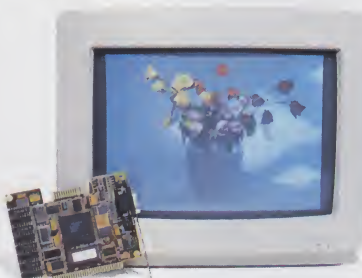


Upgrade your system with our quality video combos in monographics, color, or enhanced graphics.



Ultimate EGA Combo

Includes the NEC Multisync II monitor and a Video-7 Vega Deluxe EGA card.
51703 - \$869



VGA Combo

Includes 14" analog color monitor and a Standard Brand VGA card.
51704 - \$689



Zenith VGA Combo

Includes Zenith 14" analog flat-screen color monitor with tilt and swivel base and a Paradise VGA card.
51705 - \$989

VGA

Enhance your existing system with any of these fine VGA monitors and cards for spectacular color and clarity.

Paradise EGA-480 is an IBM/EGA-compatible card with 256KB display memory, and 16/64 color. The EGA-480 automatically configures itself to a resolution of 640x350 or 640x480, depending on your monitor. 48304 - \$199

EGA-350 card is IBM-EGA compatible 256KB display memory, with high-resolution (640x350) graphics mode. Displays 64 colors, 16 at a time. It supports EGA, CGA, and monochrome displays. 48303 - \$159



48303

Standard Brand EGA-480 card is an IBM/EGA-compatible card with 256KB display memory, 16/64 color capability, and auto-configuration. 48306 - \$179

CompuAdd - the third fastest growing privately held company in America.
Inc Magazine, Dec. 1987
1-800-627-1967

Zenith 14" Color VGA flat screen monitor with tilt and swivel base provides sharp, clear images and high resolutions of up to 720x348. Displays all graphics modes at 31.5KHz horizontal scan frequency, with 25MHz bandwidth and .31mm dot pitch. Uses flat tension mask technology for remarkable chroma, intensity, and hue. 51075 - \$759

Color VGA 14" analog monitor displays a spectrum of colors as infinite as your imagination. The 14" display has a .28mm dot pitch and 31.5KHz horizontal scan frequency. 51076 - \$515

Standard Brand VGA card enhances your monitor with high-resolution (800x600) graphics, 16/256K color capability, and IBM VGA, CGA, and Hercules Monochrome graphics. 48331 - \$220

Paradise VGA Plus™ card provides increased performance for your IBM VGA and PS/2 compatibles, attains high-resolution (800x600) graphics, displays 256K colors, 16 at a time, and supports IBM VGA, CGA, and Hercules™ Monochrome Graphics. 48330 - \$289

Video-7® Vega VGA card, compatible with all existing IBM graphic/text standards, has resolutions of 640x480 and 800x600 with 16/64 color capability. Used with an analog monitor, it has 640x480 resolution with 16/262,144 color capability or 320x200 with 256/262,144. Supports popular software packages. 48377 - \$299

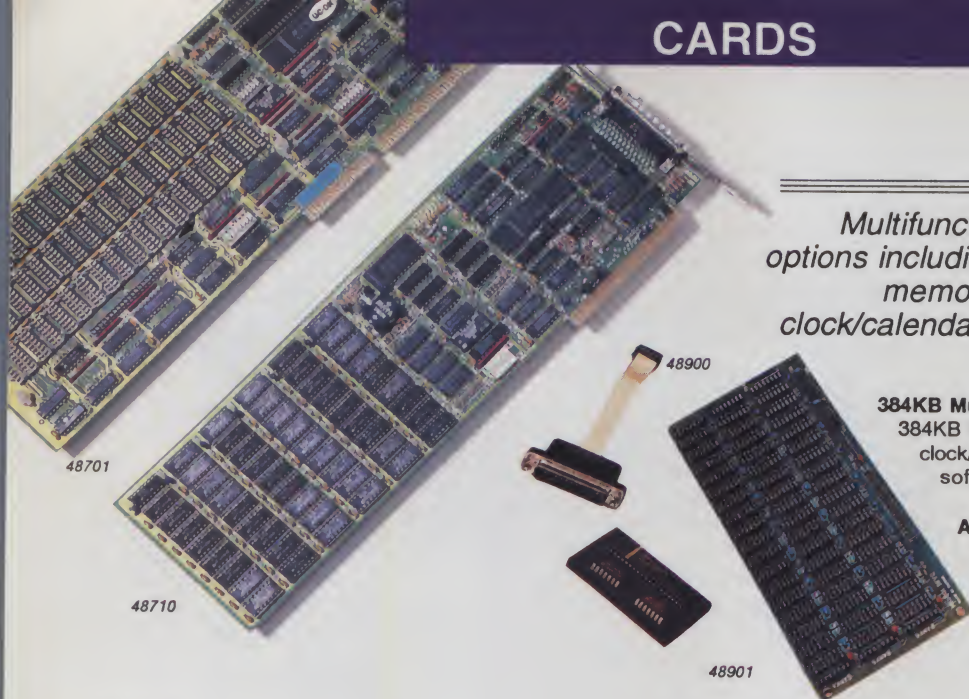


51075

48330

Multifunction cards

Multifunction cards provide a variety of options including additional random-access memory (RAM), ports, and real-time clock/calendars, to increase your system's speed and flexibility.



384KB Multifunction card for your PC/XT with 384KB RAM, parallel port, serial port, game port, clock/calendar with battery backup, and utility software. 48710 - \$199

AT-Multifunction card with 0KB is expandable to 1.5MB and supports either 64KB or 256KB chips. Includes serial and parallel ports. 48701 - \$110

AST Advantage!™ for ATs with 128KB RAM (expandable to 1.5MB). Includes serial and parallel ports. 48752 - \$228

AST SixPakPlus® for PCs with 384KB RAM, serial port, parallel port, clock/calendar with battery backup, and utility software. 48760 - \$259

Options

Second Serial Port Option for the AT I/O, XT I/O, or AT MFC cards. 48900 - \$15

AST Advantage! Game Port Option for the AST Advantage! 48951 - \$35

AT-MFC Memory Piggyback with 0KB is expandable to 1.5MB RAM. 48901 - \$25

AST Advantage! Serial Port Option for the AST Advantage! 48950 - \$35

Memory cards

Extra memory allows you to run more powerful applications and may increase the operational speed of a program.

Mem-576 short card for the PC/XT supports either 64KB or 256KB chips. It comes with 0KB and is expandable up to 192, 384, or 576KB. 48100 - \$35

XT EMS Card (Expansion-Memory-Specification) for the PC/XT, with 0KB expands to 2MB and is compatible with the Lotus/Intel/Microsoft specification. Includes virtual RAM disk and print-spooler software. 48101 - \$99

EMS Card for the AT is compatible with the Lotus/Intel/Microsoft specification and has 0KB expandable to 2MB. Includes virtual RAM disk and print-spooler software. 48102 - \$119

Accelerators

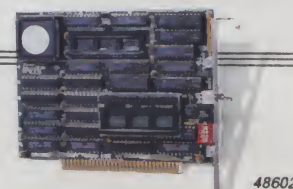
Increase your PC's processing speed to turbo speeds (higher than 4.77MHz) with an accelerator card.

Charge Card 286™ makes your PC/XT run 6.6 times faster. 48602 - \$259

48601



Orchid TinyTurbo 286™ board gives your PC/XT the power of an AT. 48601 - \$279



48602



48000

Input/output cards

Add a serial or parallel port to your system with an economical I/O card.

I/O Card for AT compatibles with serial port and parallel port. 48000 - \$59

I/O Card for PC compatibles with serial port, parallel port, game port, and clock/calendar with battery backup. 48001 - \$65

Math coprocessors

Math coprocessors speed up your calculations.



8087-3 Math coprocessor (5MHz).

50200 - \$129

8087-2 Math coprocessor (8MHz).

50201 - \$159

80287-6 Math coprocessor (6MHz).

50250 - \$199

80287-8 Math coprocessor (8MHz).

50251 - \$269

80287-10 Math coprocessor (10MHz).

50252 - \$329

80387-16 Math coprocessor (16MHz).

50275 - \$525

80387-20 Math coprocessor (20MHz).

50277 - \$779

ORDER FORM

BILLING ADDRESS			SHIPPING ADDRESS (If different from billing address)		
PHONE NUMBER		DATE	PHONE NUMBER		DATE
FIRST NAME	LAST NAME		FIRST NAME	LAST NAME	
COMPANY NAME IF APPLICABLE			COMPANY NAME IF APPLICABLE		
STREET ADDRESS (No P.O. Box Please)		APT/BLDG/SUITE	STREET ADDRESS (No P.O. Box Please)		APT/BLDG/SUITE
CITY	STATE	ZIP CODE	CITY	STATE	ZIP CODE

[illegible]

Corporate Accounts
1-800-456-3116

SPECIAL!

Copy holders

Copy holder with stand, 9.5x11". 41650 - \$9
 Copy holder with adjustable arm, 9.5x11". 41651 - \$9 (reg. \$14)
 Copy holder with stand, 19x12". 41653 - \$19
 Copy holder with adjustable arm, 19x12". 41654 - \$25
 Copy holder with stand, 9.5x11". 41655 - \$12



Floppy storage

Cases for 5.25" floppies.
 Holds 10. 41576 - \$3
 Holds 6. 41577 - \$2
 Case for 3.5" floppies.
 Holds 10. 41575 - \$3

Portable carry-case with handle for 5.25" floppies.
 Holds 120, with lock.
 41617 - \$29

File boxes for 5.25" floppies.
 Holds 50, without lock.
 41610 - \$8
 Holds 100, with lock.
 41615 - \$8
 Holds 120, with lock.
 41616 - \$9
 File boxes for 3.5" floppies.
 Holds 40, without lock.
 41598 - \$7
 Holds 80, with lock.
 41599 - \$10



Monitor stands

12" Tilt/swivel monitor stand.
 11" x 10". 41565 - \$15
 14" Tilt/swivel monitor stand.
 14" x 12.75". 41566 - \$19



Teak office accessories — Personalize your office with these handsome accessories.



Teak turntable monitor base provides easy viewing. 15.75" x 13.25". 41567 - \$29
 Teak disk file for 50, 5.25" diskettes. 41600 - \$25
 Teak disk file for 45, 3.5" diskettes. 41611 - \$19

Blank floppies

Packed in boxes of 10.

SPECIAL!

5.25" Floppies
 360KB DS/DD.
 57000 - \$4.99 (Reg. \$7)
 360KB Maxell® DS/DD.
 57004 - \$9
 360KB Verbatim® DS/DD.
 57002 - \$10
 1.2MB DS/HD.
 57200 - \$10.99 (Reg. \$12)
 1.2MB Maxell DS/HD.
 57202 - \$18
 1.2MB Verbatim DS/HD.
 57201 - \$17

3.5" Floppies
 720KB Sony® DS/DD.
 57401 - \$19
 1.44MB Sony DS/HD.
 57440 - \$55

System stands

Plastic vertical system stand.
 41555 - \$15
 Metal vertical system stand.
 41556 - \$19



Hewlett-Packard accessories

Transparency pens
 Five colors, .3mm.
 37550 - \$6.50
 Five colors, .6mm.
 37551 - \$6.50
 Fiber tip pens
 4 colors, .3mm.
 37500 - \$6.50
 4 colors, .7mm.
 37501 - \$6.50
 6 colors, .3mm.
 37510 - \$6.50
 6 colors, .7mm.
 37511 - \$6.50
 Plotter paper
 Size A, 50 sheets. 35500 - \$5
 Size B, 50 sheets. 35501 - \$9
 PaintJet paper
 35510 - \$15.50
 Transparency film for the ColorPro Plotter
 Size A film. 37605 - \$45
 Size B film. 37606 - \$45
 PaintJet film. 37607 - \$55

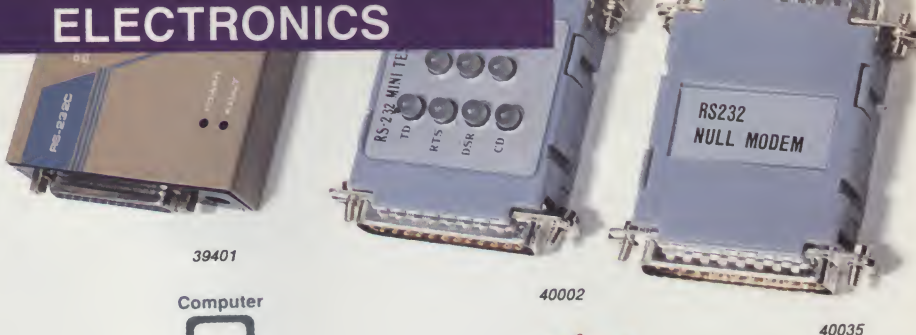
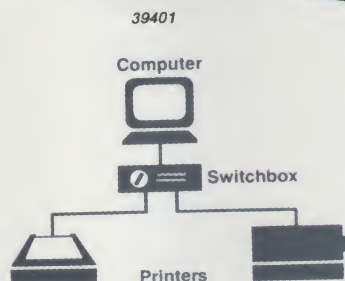
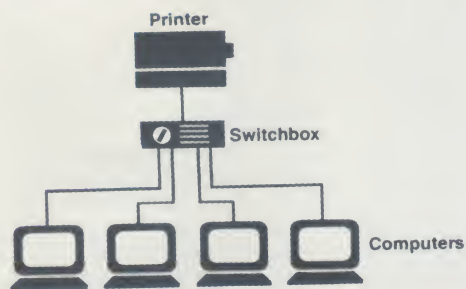


Transparency Kit for HP plotter, includes film and pens. 37600 - \$64



Hewlett-Packard offers a variety of soft fonts and font cartridges that enhance your printed documents. Call CompuAdd for more information. 1-800-627-1967

Electronic supplies



Null modems

Null modems are used for in-line connection of like devices.

Male to male. 40035 - \$5
Male to female. 40036 - \$5
Female to female. 40037 - \$5

Converters

For communication between different interfaces, use a converter.

DB9F to DB25M. 39402 - \$9
Parallel to serial. 39401 - \$45
Serial to parallel. 39400 - \$45

Jumper boxes

Jumper boxes custom design in-line adapters for non-standard ports.

Male to female. 40000 - \$6
Male to male. 40001 - \$6
Female to female. 39999 - \$7

SPECIAL!

Gender changers

Connect cables with the same type of connector ends.

Male to male (DB25).
40020 - \$2.99 (Reg. \$6)
Female to female (DB25).
40021 - \$6

Testers

Mini-Tester (M-F) tests for faulty RS-232 interfaces.
40002 - \$9

Manual switch boxes

Multiple users can share peripherals or a single user can use many peripherals with the flip of a switch. Numbers in parentheses reflect computers/peripherals.

SPECIAL!



25-Pin (serial or parallel):

39506 X switch box (2/2). \$35
39500 AB switch box (2/1). \$10 (Reg. \$25)
39502 ABC switch box (3/1). \$30
39504 ABCD switch box (4/1). \$33

Also available with Centronics 36-pin connectors.

Automatic switch boxes

These devices automatically queue print jobs. Available with DB25F connectors. Numbers in parentheses reflect computers/peripherals.



38952 Serial auto switch box (4/1). \$75
38953 Serial auto switch box (8/1). \$99
38950 Parallel auto switch box (4/1). \$80
38951 Parallel auto switch box (8/1). \$99



38900 64KB buffer (1/1). \$80
38901 64KB buffer (2/1). \$99

Buffers

Increase productivity by printing and computing at the same time. All buffers connect with Centronics parallel interfaces. Numbers in parentheses indicate computers/peripherals.

40504

Surge suppressors

Surges of power can cause serious damage to your computer and erase valuable data.

RS-232 (M-F) surge protector for serial ports. 40005 - \$6
6-outlet basic surge protector with circuit breaker. 40502 - \$12
6-outlet full surge protector with surge indicator light. 40503 - \$15
6-outlet full surge protector with light and noise filter. 40504 - \$16
4-outlet protector with light and noise filter and EMI-RFI filtration. 40506 - \$18

6-outlet full protector with light and noise filter and EMI-RFI filtration. 40505 - \$20
Curtis Emerald®, 6 outlets, 6' cable, circuit breaker, and warranty. 40529 - \$37
Curtis Ruby®, 6 outlets, EMI-RFI filtered, 6' cable, circuit breaker, and warranty. 40530 - \$55
Curtis Ruby Plus®, includes modem protection. 40531 - \$65

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Dot-matrix printers

Epson®

Model LX-800 provides draft (180cps) or near letter quality printing (30cps), multiple type styles, Epson Character Graphics set, and dot-graphics capability. Automatic single sheet load and pull tractor feed. Parallel interface. (80 columns). **56301 - \$205**

The FX series 9-pin, dot-matrix printers. Prints 264cps in draft mode and 54cps in near letter quality. Automatic sheet load and friction/pull tractor feed. Parallel interface.

Model FX-850 (80 columns). **56312 - \$375**

Model FX-1050 (136 columns). **56313 - \$549**

The EX-800 Prints 300cps in draft mode and 60cps in near letter quality mode. Automatic sheet load and bidirectional push tractor feed. Parallel/serial interface. (80 columns). **56320 - \$476**

The LQ series features a 24-pin print head that produces letter quality printing. The LQ-500 printer prints 180cps in draft mode and 60cps in letter quality mode. The LQ-2500 printer prints 324cps in draft mode and 108cps in letter quality mode. Both include an 8KB buffer, pull tractor feed, and a Centronics®-compatible, 8-bit parallel interface. The LQ-850 and LQ-1050 printers print 264cps in draft mode and 88cps in letter quality mode. Each includes 64KB buffer, push tractor feed, and serial and parallel interfaces.

Model LQ-500 (80 columns). **56335 - \$365**

Model LQ-850 (80 columns). **56334 - \$576**

Model LQ-1050 (132 columns). **56333 - \$699**

Model LQ-2500 (132 columns). **56331 - \$923**

Okidata®

The Microline® 190 series uses either an adjustable pin feed (192 Plus) or adjustable tractor feed (193 Plus). Prints up to 200cps in draft mode and 40cps in near letter quality mode. Parallel interface.

192 Plus (80 columns). **56350 - \$329**

193 Plus (132 columns). **56351 - \$479**

The Microline 292/293 series reproduces graphics, spreadsheets, and text files using a dual 9-pin print head and a special Lotus®-compatible



driver. They print 240cps in draft mode and 100cps in near letter quality mode. Parallel interface kit included.

292e Microline (80 columns). **56356 - \$459**

293e Microline (132 columns). **56357 - \$599**



The wide-carriage Microline 294 is faster and more versatile than many other comparably priced printers. Prints in draft mode at 400cps and near letter quality at 100cps. Its pinless platen and forms tractor feed handles sheets up to 16" wide. Parallel port. (132 columns). **56358 - \$849**

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Panasonic®

Editor's
Choice
Nov. 10, 1987



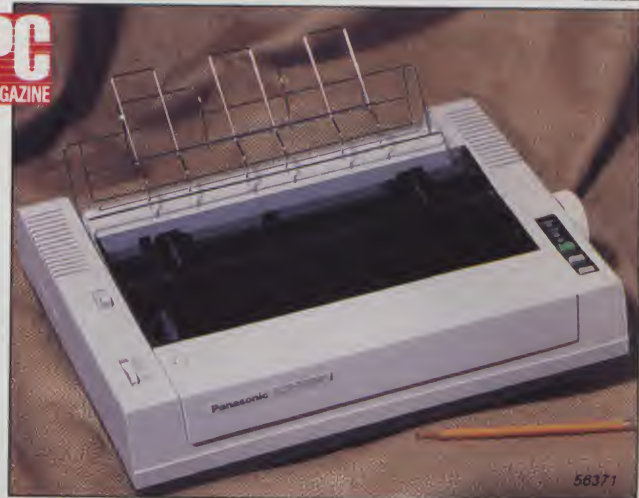
Model 1080i is a 10" printer operating at 120cps in draft mode and 24cps in near letter quality mode. It features proportional spacing, print mode selector, and high-resolution graphics. Adjustable rear tractor feed and friction feed. Parallel interface. (80 columns). **56370 - \$179**

Model 1091i prints at 160cps in draft mode and 32cps in near letter quality. This 10" printer, offers all the features of the 1080i with increased speed. Adjustable rear tractor feed and friction feed. Parallel interface. (80 columns). **56371 - \$219**

Model 1092i prints at 240cps in draft mode and 48cps in near letter quality mode with proportional spacing, high-resolution, dot-addressable graphics, and downloadable characters. Adjustable push tractor feed and friction feed. Parallel interface. (80 columns). **56372 - \$349**

Model 1592 is a high performance printer that prints at 180cps in draft mode and 38cps in near letter quality mode. Adjustable rear tractor feed and friction feed. Parallel interface. (132 columns). **56373 - \$449**

Model 1595 prints at 240cps in draft mode and 51cps in near letter quality mode. Adjustable rear tractor feed and friction feed. Parallel and serial interface. (132 columns). **56374 - \$479**



Printer stands

Organize printer paper and create more workspace with a durable printer stand.

Roll 'N' Fold stand for 80-column printer keeps paper neat and out of the way. Fits printers up to 16" x 15".
38755 - \$29



Roll 'N' Fold stand for 132-column printer. 20.875" x 15".
38756 - \$35

Universal printer stand is made of heavy duty plastic and holds any size printer (without tray). (12" -> 19.75") x 12".
38760 - \$9

Multifunction printer stand for 80-column printer with under-printer drawer (plastic).
38765 - \$19

No Frills plastic stand for 80-column printer. 12.75" x 11.75" x 5.5".
38748 - \$12

No Frills metal stand for 132-column printer 21.25" x 13" x 5.5" (drawer is 14.875" wide).
38749 - \$26

Printer ribbons

For Epson models

FX-1050. 37902 - \$6
FX-850/LX-800. 37901 - \$6
EX-800. 37930 - \$12
LQ-850. 37915 - \$8
LQ-1050. 37916 - \$10

For Okidata models

192/193. 37955 - \$10
292e. 37956 - \$10
293e/294. 37957 - \$13

For Panasonic models

1080i, 1091i, 1092i, 1592, 1595.
37976 - \$12

For Star model

NX-1000. 38066 - \$6

Tractor feeds

For Okidata models

192. 37850 - \$49
292e. 37851 - \$46

For Panasonic Model

1595. 37875 - \$109



Printer muffler for 80-column printer (19" x 16" x 6").
38795 - \$48

Printer mufflers

Kensington® mufflers control noise making your printer a more pleasant co-worker.

Printer muffler for 132-column printer (26" x 16.25" x 8.5").
38796 - \$62

Modems

Modems allow your computer to communicate with other computers over telephone lines. The greater the baud rate, the more quickly your data is transmitted.

Internal modems

1200 baud 1/2 card internal modem with software.
49500 - \$69

2400 baud internal modem with software.
49553 - \$139

Everex Evercom™ 1200 baud 1/2 card internal modem with software.
49502 - \$99

Everex Evercom 2400 baud 1/2 card internal modem with software.
49551 - \$149

Everex Evercom II 24™ 2400 baud internal modem designed for the Micro Channel™ architecture of the Personal System/2™. Includes communications software.
49554 - \$179



Hayes Smartmodem™ 1200B 1200 baud 1/2 card internal modem with Smartcom II software.
49526 - \$299

Hayes 2400B 2400 baud internal modem.
49552 - \$449

Zenith 1200 baud internal modem.
62805 - \$209

Zenith 2400 baud internal modem for Zenith 181 and 183 models.
62806 - \$472

External modems

External modems require a serial port and cable.

1200 baud external modem.
49525 - \$89

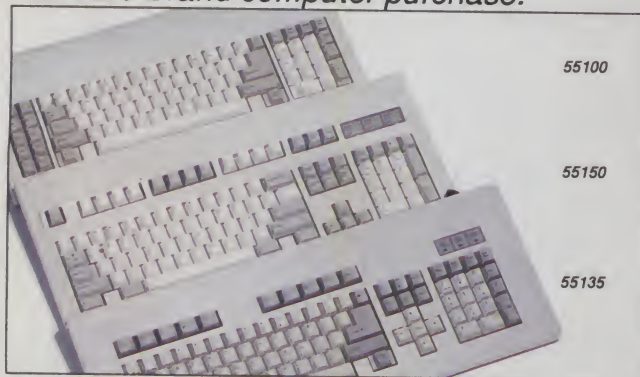
2400 baud external modem.
49557 - \$159

Everex 2400 baud external modem.
49575 - \$229

Hayes Smartmodem 1200 baud external modem.
49501 - \$319

Hayes 2400 baud external modem.
49576 - \$469

Keyboards — Your choice with any Standard Brand computer purchase.



AT-Style 5060 keyboard has 84 keys and enlarged ENTER and SHIFT keys for easy operation. 55100 - \$89
Enhanced 101-key keyboard for AT or PC/XT compatibles with 101 keys including 12 function keys. 55150 - \$69
5151 keyboard for the IBM AT, PC/XT, and compatibles. Includes separate numeric and cursor key pads. 55135 - \$69

Keyboard drawers

Undercarriage keyboard drawer attaches easily under desktop or shelf. Inside dimensions are 22.4" x 10.1" x 3.6". 41753 - \$25

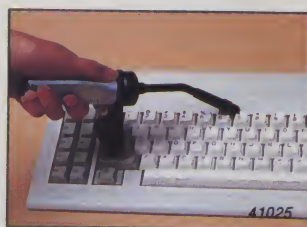
Keyboard drawer for out-of-the-way storage under CPU or monitor. 41750 - \$35



Cleaners — Clean up your computer's act. A clean system means better protection and performance.

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Head cleaning kit for 5.25" disk drive. 41001 - \$9.39 (Reg. \$12)
Head cleaning kit for 3.5" disk drive. 41000 - \$15
Compuduster, compressed gas and valve assembly for cleaning. 41010 - \$24
Mini Vacuum helps remove the dust that accumulates on your keyboard. 41025 - \$9
Screen cleaning kit. 41020 - \$16
Standard Brand cleaning kit. Includes keyboard, screen, and 5.25" drive cleaner. 41016 - \$16



Microcomputer cleaning kit for complete cleaning including 5.25" floppy drives and screen. 41015 - \$25
Data-Vac® is a lightweight vacuum/blower (three pounds) equipped with a 19" flexible hose, a shoulder strap, and three attachments for intricate cleaning of your system. Five vacuum bags included. 41026 - \$49
Data-Vac Replacement Bags (5). 41035 - \$4.99

Pointing devices

The Mouse

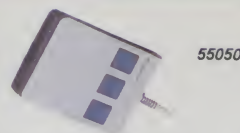
Essential for desktop publishing, the mouse can also be used in many programs for easy cursor movement.

Logitech® HiREZ mouse provides 320 dots per inch. This three-button mouse uses 62% less desk space. Bus interface. 55048 - \$109

Logitech serial mouse is a programmable mouse with three buttons. Includes software and manual. *PC Magazine* Editor's Choice (Jan. 27, 1987). Serial port interface required. 55050 - \$79

Logitech bus mouse is a three-button optical mouse that offers high resolution (200 dpi) and maximum compatibility with most software. Includes bus interface card. 55049 - \$89

Microsoft® bus mouse is a mechanical mouse with bus interface. 55051 - \$119



Standard Brand™ mouse is a three button optical/mechanical mouse that features Dr. HALO III paint software for presentation-quality graphics. Supports MGA, CGA, EGA, and VGA. 55052 - \$55



Standard Brand joystick. 55000 - \$19.95

Mach III joystick. 55001 - \$35

Covers — Protect your computer when it is not in use with these attractive and handy covers.

SPECIAL!



Dust cover for PC/XT. Clear plastic. 37" x 18". 41775 - \$3.49 (Reg. \$6)

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Disk drive cover for PC/XT. Black rigid plastic. 12.25" x 3.625". 41695 - \$5
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
Cables — CompuAdd offers a complete line of parallel, serial, and extension cables for your computer. Call 1-800-627-1967 for one of our helpful representatives.






Desktop publishing

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Version 5.0



WordPerfect® by WordPerfect Corporation offers you a powerful word processor. (256KB RAM/MS-DOS 2.0).
60015 - \$219
(3.5" 60016 - \$219) ①

PFS: First Publisher by Software Publishing makes desktop publishing affordable. (512KB RAM/MS-DOS 2.0).
59416 - \$73 ☐ ☒ 

FANTASY® by Prosoft features graphics, 28 type styles, proportional spacing, and reversal capability. (512KB RAM for 9-pin printers (640KB RAM for 24-pin printers) and MS-DOS 2.0)).
59420 - \$35

NewsMaster II™ by Unison
World combines text and
graphics for results. (512KB
RAM/MS-DOS 2.1).
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The Newsroom® by Springboard makes you editor-in-chief. With five type styles, automatic text layout, graphics, clip-art, and modem support. (256KB RAM/MS-DOS 2.0-3.0). 59425 - \$35

The Newsroom Pro™ by Springboard includes more graphics, text/graphics manipulations — more everything! (512KB RAM/MS-DOS 2.0).
59426 - \$42  

PrintMaster Plus™ by Unison
World creates custom fliers,
banners, calendars, and
stationery. (256KB RAM/MS-
DOS 2.0). 61015 - \$30

The Print Shop® by Broderbund effectively catches your audience's attention with eye-catching material. The Print Shop helps you enliven your printed word with riveting design and graphics. In just minutes, you can have professional-looking results — everything from banners to bulletins. Your work will never look boring again - not with 12 type fonts, 16 border designs, 20 background patterns, and 120 graphics from which to choose! (128KB RAM/MS-DOS 2.0).
61050 - \$32 (Reg. \$38)

The Print Shop Companion™ by Broderbund gives your Print Shop program a flexible clip art collection. (128KB RAM/MS-DOS 2.0-3.0). 59806 - \$28







PrintPower™ by Hi Tech Expressions is the quick and easy way to express yourself. Create customized signs or stationery with the six type faces and 40 borders. Should words fail, choose from 60 high-resolution graphics to get your point across! (256KB RAM).

59407 - **\$7.49** (reg. **\$8**) 

AutoDimensioning™ by
Generic Software, the productiv-
ity module for use with Generic
CADD, helps you with dimen-
sioning. (384KB RAM/MS-DOS
2.0). 59830 - **\$25** ☐ ☐ ☒ ★

FormTool by Bloc Development Corporation ends typesetting costs for new and revised forms by creating custom forms. (256KB RAM). 59831 - **\$54**

Generic CADD™ by Generic Software assists you with technical and design drafting. Merges with text files. (384KB RAM/MS-DOS 2.0).
59825 - \$50    

PC Paint Plus by Mouse Systems easily merges graphs from other programs to enhance presentations. (256KB RAM/MS-DOS). 59800 - **\$53**

- | | | |
|---------------------------|-----------------|-----------------------|
| () RAM/DOS required. | ○ Supports MGA. | ★ Supports VGA. |
| ■ 3.5 floppies Included. | ◐ Supports CGA. | ✓ RAM resident. |
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Database management

dBASE III PLUS™ by Ashton-Tate includes fully-relational database, built-in networking system, and management system. (256KB RAM/MS-DOS 2.0). 60600 - \$409

Q&A™ by Symantec gives you a powerful database that is easy to set up, a report generator that offers advanced options, and a word processor. (512KB RAM). 60615 - \$199 ☐



Spreadsheets

Quattro™ by Borland International provides increased speed for spreadsheet tasks. (384KB RAM/MS-DOS 2.0). 60122 - \$159 ☐ ★ ★

Sideways® by Funk Software enables you to print large files continuously by printing sideways. (64KB RAM). 58580 - \$40 ☐

VP-Planner® by Paperback is a multi-dimensional database that creates user-defined spreadsheets. (256KB RAM). 60130 - \$49

Integrated packages

Ability™ by Migent features word processing, spreadsheet, database, graphics, telecommunication, and audio/visual presentation applications. (384KB RAM). 60102 - \$59

PFS: First Choice by Software Publishing offers word processing, spreadsheets, business graphics, and communications. (512KB RAM/MS-DOS 2.0). 60605 - \$89 ☐

Microsoft® Works by Microsoft surpasses the competition with its sophisticated applications. (384KB RAM/MS-DOS 2.0). 60614 - \$129

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Finance

DAC-Easy™ Accounting by DAC Software handles your general ledger, receivables, payables functions, inventory, ordering, and forecasting tasks. (256KB RAM/MS-DOS 2.0). 60816 - \$57 ☐

DAC-Easy Light™ by DAC Software installs quickly to furnish the non-accountant with a personal finance package. (256KB RAM/MS-DOS 2.0). 60817 - \$40 ☐

Managing Your Money® by Meca includes a full complement of personal finance applications. (256KB RAM/MS-DOS 2.0). 60800 - \$125

Quicken® by Intuit makes personal and business bookkeeping a breeze. (256KB RAM/MS-DOS 2.0). 60801 - \$28

☐ ☐ ★



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CompuServe® Subscription Kit offers easy access to electronic services and online databases. 59110 - \$21

Crosstalk XVI® by MicroStuf has extensive prompts that make it an extremely easy communications package. (96KB RAM). 59000 - \$99

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Coffee Break by MPPI keeps data secure when you are away from your desk. (9.7KB RAM/MS-DOS). 58595 - \$21



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Microsoft Macro Assembler by Microsoft assists you in writing subroutines with an easy-to-use code. (320KB RAM/MS-DOS 2.0 or OS/2 1.0). 58212 - \$100 ☐

Microsoft Quick BASIC by Microsoft speeds up the programming process by eliminating the lengthy compile step. The full-screen editor aids in debugging. (320KB RAM/MS-DOS 2.1). 58235 - \$65

Turbo C® by Borland is optimized to whizz through compilation. Includes a library of exceptional quality graphics. (384KB RAM/MS-DOS 2.0). 58202 - \$63

Turbo Pascal® by Borland powers up your computer with the Pascal language. (384KB RAM (integrated environment) or 256KB RAM (command line)). 58201 - \$62

FASTBACK Plus by 5th Generation is now even easier and faster backing up your disk. (448KB RAM/MS-DOS 2.1). 58556 - \$95 (3.5" 58557 - \$95)

GOfier™ by Microlytics finds where your data is hiding. (256KB RAM/MS-DOS 2.0). 58608 - \$40 ☐ ①

Norton Utilities™ Advanced Edition by Peter Norton Computing optimizes your disk and performs all those practical utilities for which Norton is famous. 58536 - \$79 ☐

PC-FullBak™ by Westlake Data quickly backs up and restores files from your hard disk to protect your crucial data. (128KB RAM/MS-DOS 2.0). 58600 - \$49

PC Tools® Deluxe by Central Point Software manages directories and recovers deleted files. (192KB RAM). 58566 - \$40

PathMinder™ by Westlake Data manages your computer's directories and files. (256KB RAM/MS-DOS 2.0-3.2). 58598 - \$36



Utilities

Copy II® PC by Central Point Software lets you create backup copies of most copy-protected software. (256KB RAM). 58565 - \$19

Disk Optimizer™ by SoftLogic Solutions safely reorganizes your disk for reduced access time. (128KB RAM/MS-DOS 2.0). 58560 - \$39

TOPS For DOS® by TOPS links IBM-compatible computers with Apple Macintoshes and UNIX computers. (512KB RAM/MS-DOS 3.0). 58603 - \$116 ✓

XTREE™ by Executive Systems simplifies file and directory management. (192KB RAM/MS-DOS 2.0). 58575 - \$35 ①



Games

Ancient Art of War at Sea™ by Broderbund lets you experience the adventure of the high seas. (256KB RAM/MS-DOS 2.0). 61570 - \$25 ☐ ☐ ☐

The Bard's Tale by Electronic Arts offers more dungeons, more monsters, and more logic problems. 3-D. (MS-DOS 2.0). 61550 - \$30 ☐ ☒ ☐

Chuck Yeager's Advanced Flight Trainer™ by Electronic Arts pushes the envelope of flight training software. (256KB RAM/MS-DOS 2.0). 61503 - \$24 ☒ ☐ ☐ ☒

Defender of the Crown™ by Master Designer has you restoring order to medieval England. (256KB RAM/MS-DOS 2.0). 61552 - \$23 ☐ ☒

Earl Weaver Baseball by Electronic Arts give you all the action between the foul lines. (256KB RAM). 61526 - \$24 ☐ ☒

Falcon by Spectrum HoloByte captures the sensation of piloting a F-16A Fighting Falcon. (256KB RAM/MS-DOS 2.0 or 384KB RAM/MS-DOS 3.0). 61554 - \$25 ☒ ☐ ☐

Flight Simulator by Microsoft has challenging realism and graphics that make it the aerial simulation standard! (128KB RAM). 61500 - \$34

Gunship™ by MicroProse offers high-speed aerial action while you control an attack helicopter. (256KB RAM). 61574 - \$28 ☐ ☒ ☒

3-D Helicopter Simulator™ by Sierra employs 16-color, 3-D, and 360° scan for incredible flight simulation. (256KB RAM). 61502 - \$28 ☒ ☐ ☐ ☒



Jeopardy!™ by ShareData tests your trivia knowledge. There are over a 1,000 questions to answer as you race to the Double Jeopardy! round. Remember — be sure to put your answer in the form of a question! (256KB RAM/MS-DOS 2.11). 61542 - \$6.50 (Reg. \$7) ☐ ☒

Jet by SubLOGIC puts you in the cockpit of the technologically advanced F-16 or F-18 fighting jet. (128KB RAM). 61510 - \$31 ☐ ☒

King's Quest™ III: To Heir is Human by Sierra is a graphics-adventure program with 3-D animation. (256KB RAM/MS-DOS). 61523 - \$30

Leisure Suit Larry in the Land of the Lounge Lizards™ by Sierra takes you on a humorous quest for a good time with wild and crazy Larry. (256KB RAM). For adults. 61546 - \$23 ☒ ☐ ☐ ☒ ☒

Mean 18 Golf by Accolade provides you with definitive golf simulation. (256KB RAM). 61529 - \$24 ☐ ☒

Mean 18 Course Disk Volume II by Accolade puts you on the greens of famous courses. Requires Mean 18 Golf to play. 61530 - \$10

Sargon III® by Hayden Software allows you to take back moves, change sides, and study classic chess problems. (128KB RAM). 61528 - \$12

Scenery Disks enhance your Jet(1.3) and Flight Simulator (2.0) programs by increasing the variety of terrain.

Scenery Disk: LA, San Fran, Las Vegas. 61512 - \$16

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Space Quest II: Vohaul's Revenge by Sierra has Roger Wilco trying to remove the threat of invasion by the dreaded insurance salesmen. (256KB RAM). 61562 - \$28 ☒ ☐ ☐ ☒ ☒

Math Blaster Plus!™ by Davidson & Assoc. uses five learning activities, color animation, and "Blasternaut" math game to add to the fun of learning. (256KB RAM/MS-DOS 2.0). 61025 - \$25 ☐

Math Rabbit™ by The Learning Co. teaches basic math and math concepts. (128KB RAM/MS-DOS 2.0). 61027 - \$20 ☐ ☐ ☐



Reader Rabbit™ by The Learning Co. gives your child a headstart. Keeps your child captivated with graphics as it teaches reading, spelling, and memory skills. The lessons are developed from current curriculums and are reinforced through four amusing animated games. Designed for 4-10 year olds. (256KB RAM/MS-DOS). 61035 - \$19 (Reg. \$25) ☐

Think Quick™ by The Learning Co. sharpens your child's analytical and learning abilities. 61036 - \$25



Typing Tutor IV by Simon & Schuster dramatically increases your typing speed and accuracy. This program evaluates your keyboard skills and tailors lessons to your abilities. Includes the Letter Invaders™ game. (128KB RAM/MS-DOS 2.0). 61020 - \$28 (Reg. \$32) (3.5" 61021 - \$28) (Reg. \$32)

Wizard of Words™ by Advanced Ideas increases children's reading, spelling, and vocabulary skills. (128KB RAM). 61045 - \$25 ☐ ☐

Where in the USA is Carmen Sandiego? by Broderbund has you scouring the USA to follow the trail of Carmen and her gang. 61521 - \$30 ☐

Education

Alge-Blaster!™ by Davidson & Assoc. helps develop a strong foundation in algebra fundamentals. (128KB RAM/MS-DOS 2.0). 61030 - \$26 ☐

Learning DOS by Microsoft is a comprehensive guide to understanding your operating system. (256KB RAM/MS-DOS 2.0). 61000 - \$33 (3.5" 61001 - \$33)

() RAM/DOS required.	<input type="radio"/> Supports MGA.	<input checked="" type="checkbox"/> Supports VGA.
<input checked="" type="checkbox"/> 3.5 floppies included.	<input type="checkbox"/> Supports CGA.	<input checked="" type="checkbox"/> RAM resident.
<input type="checkbox"/> 3.5 floppies available.	<input checked="" type="checkbox"/> Supports EGA.	<input type="checkbox"/> Not copy-protected.

Calculators — Add up your savings with Hewlett-Packard and Sharp® calculators from CompuAdd.



Hewlett-Packard calculators

Hewlett-Packard Financial Calculator (HP-12C) solves your everyday business calculations. It features five financial registers, 99 lines of program memory, diagnostic self-check without program loss, RPN logic system with automatic four memory stack, error recovery, stack manipulations, and 20 registers. 52050 - \$69.95

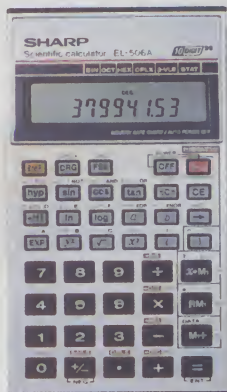
Hewlett-Packard Business Calculator (HP-17B) performs business and finance functions such as list-based one- and two-variable statistics and forecasting. Features continuous calculator memory and 2-line alphanumeric display. 52051 - \$95.95

Sharp calculators

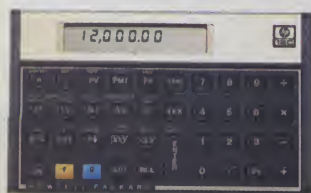
Sharp Scientific Calculator (EL-509S) is preprogrammed with 56 scientific and statistical functions. It features 15-level, nested parentheses capability; 8-digit LCD display; and four-key memory. 52010 - \$13.99

SPECIAL!

Sharp Two-Memory Scientific Calculator (EL-506A) has a 10-digit display and is preprogrammed with 93 scientific and statistical functions. It features hex, octal, and binary calculations; probability calculations with normal distribution random variables; 15-level, nested parentheses capability; and 3-key memory x 2. 52009 - \$15.99 (Reg. \$19.99)

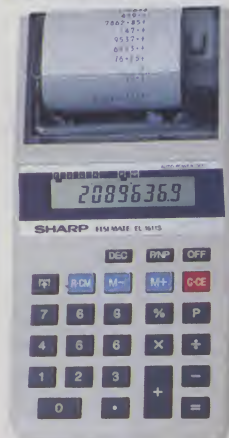


52009



52050

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52003

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52006

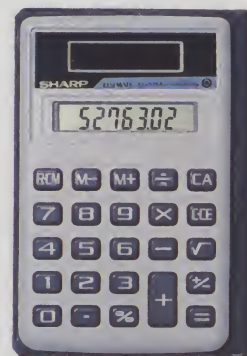
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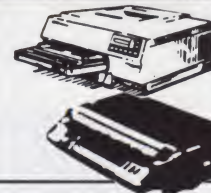
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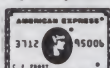
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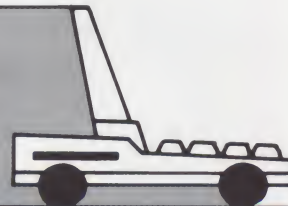
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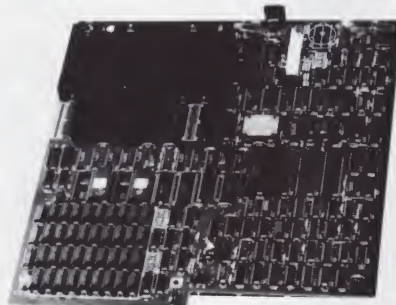
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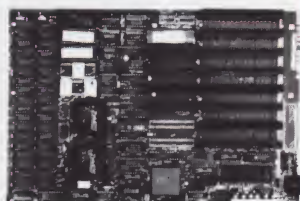
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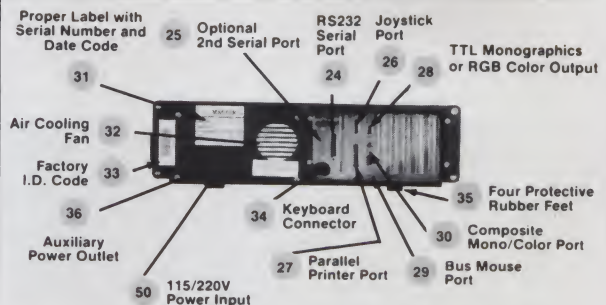
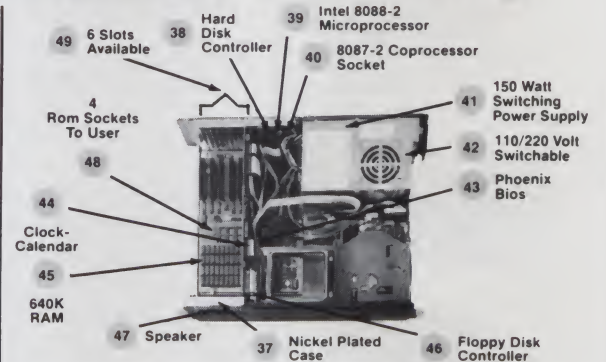
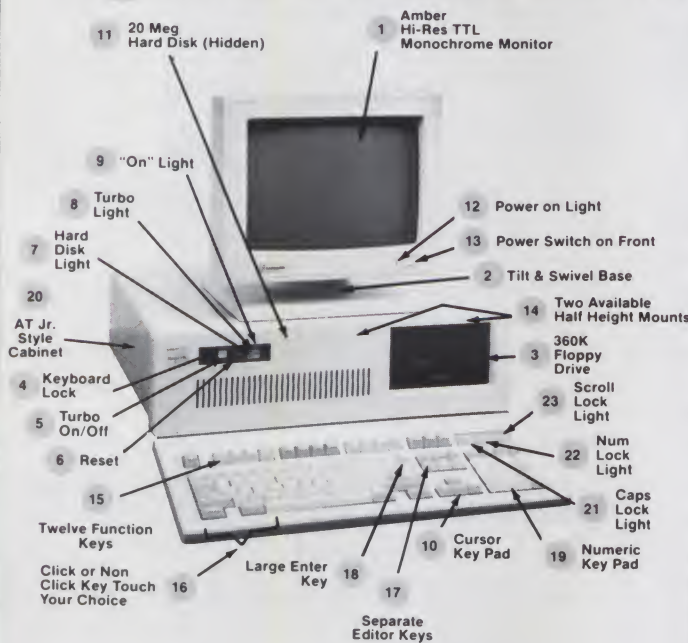
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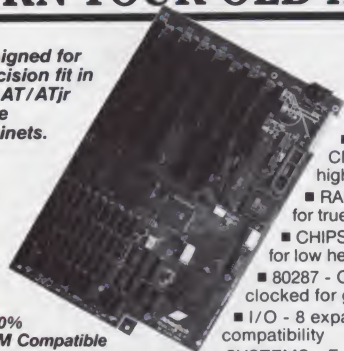
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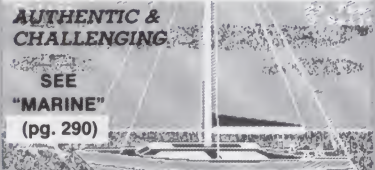
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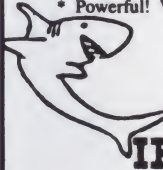
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
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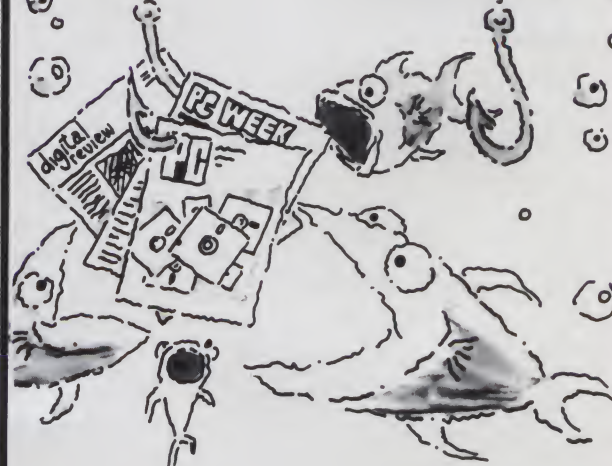
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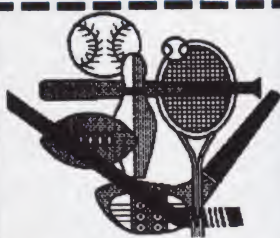
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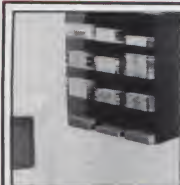
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From euphoria...

You want to experience it again. So you do some more coke.

Once more, you like the effects. It's a very clean high. It doesn't really feel like you're drugged. Only this time, you notice you don't feel so good when you come down. You're confused, edgy, anxious, even depressed.

Fortunately, that's easy to fix. At least for the next 20 minutes or so. All it takes is another few lines, or a few more hits on the pipe.

You're discovering one of the things that makes cocaine so dangerous.

It compels you to keep on using it. (Given unlimited access, laboratory monkeys take cocaine until they have seizures and die.)

If you keep experimenting with cocaine, quite soon you may feel you need it just to

function well. To perform better at work, to cope with stress, to escape depression, just to have a good time at a party or a concert.

Like speed, cocaine makes you talk a lot and sleep a little. You can't sit still. You have difficulty concentrating and remembering. You feel aggressive and suspicious towards people. You don't want to eat very much. You become uninterested in sex.

To paranoia...

Compulsion is now definitely addiction. And there's worse to come.

You stop caring how you look or how you feel. You become paranoid. You may feel people are persecuting you, and you may have an intense fear that the police are waiting to arrest you. (Not surprising, since cocaine is illegal.)

You may have hallucinations. Because coke heightens your senses, they may seem terrifyingly real.

As one woman overdosed, she heard laughter nearby and a voice that said, "I've got you now." So many people have been totally convinced that

bugs were crawling on or out of their skin, that the hallucination has a nickname: the coke bugs.

Especially if you've been smoking cocaine, you may become violent, or feel suicidal.

When coke gets you really strung out, you may turn to other drugs to slow down. Particularly downers like alcohol, tranquilizers, marijuana and heroin. (A speedball—heroin and cocaine—is what killed John Belushi.)

If you saw your doctor now and he didn't know you were using coke, he'd probably diagnose you as a manic-depressive.

To psychosis...

Literally, you're crazy.

But you know what's truly frightening? Despite everything that's happening to you, even now, you may still feel totally in control.

That's the drug talking. Cocaine really does make you blind to reality. And with what's known about it today, you probably have to be something else to start using coke in the first place.

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- g ☐ 5 or less i ☐ 10-20
h ☐ 5-10 j ☐ 20 or more

4 What kind of computers do you currently use (check all that apply):

- k ☐ IBM/Compatible
l ☐ MAC/Apple n ☐ Mainframe
m ☐ Minicomputer o ☐ Other

5 Do you plan to buy any of the hardware or software mentioned below in the next 12 months (check all that apply):

Hardware

- p ☐ PC
q ☐ Printer/Plotter
r ☐ Monitor
s ☐ Disk/Tape Back-up
t ☐ Add-in Board
u ☐ Communications

Software

- v ☐ Accounting
w ☐ Spreadsheet/Financial Planner
x ☐ Product Managers
y ☐ Word Processors
z ☐ Database Managers
1 ☐ Graphics
2 ☐ CAD/CAM
3 ☐ Communications

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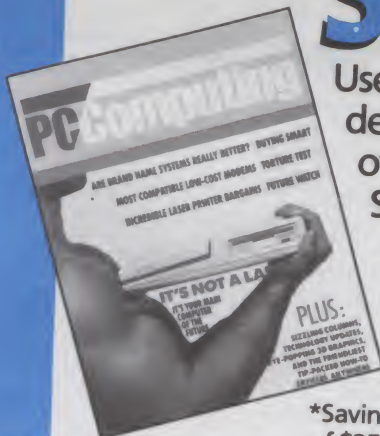
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Lucid 3-D™ is the best spreadsheet you can buy.

Don't take our word for it. Use Lucid 3-D for 60 days. Return it for a full refund if not completely satisfied. Plus, instead of the \$199 list price, an introductory spread-the-word price of \$149.



Winner of PC Magazine's 1987 Award for Technical Excellence

Lucid 3-D is priced to sell at \$199, but we want thousands of people using Lucid everyday, all over the world. We invite you to be a part of that group. The reason we are offering Lucid for only \$149, on a sixty day return for a full refund, is simple. Preliminary user testing of the product produces the same results over and over. People tell us they would never work without Lucid 3-D again. Even folks continuing to work with 1-2-3.

Memory Resident

That's because the idea of a memory resident spreadsheet makes sense, one that you can pop-up instantly while working in your word processor or any other program. Lucid lets you cut anything on the screen and paste it right into Lucid, or cut anything from a Lucid worksheet and paste into the application below. You

can even run Lucid on top of 1-2-3 if you like, and cut and paste information from one to the other, including formulas.

Lucid 3-D was developed over the past two years with countless, exhaustive hours of planning and programming to produce something spectacular. This is a product that works the way we dreamed a spreadsheet would function. Everyone who has seen it says things like, "Lucid 3-D is how software of the 1990's will look and perform", or even more to the point "This is the way I thought a computer should work". You'll see, Lucid is exciting.

Masterwork

We could go on at great length about all the features and innovations in Lucid, but Lucid is more than a bag of features. What is most important is the pride and craftsmanship that went into its creation. It is a masterwork. The overall feel is tight and polished. In fact Paul, Somerson, editorial director of *PC Computing*, used one word to describe it, "Slick".

PCSG has built a reputation as a development laboratory producing products that you know are excellent. In 1983 PCSG dominated the Model 100 laptop market with ROM based software that every reviewer rated as

CIRCLE NO. 144 ON READER SERVICE CARD.



POP-UP 3 DIMENSIONAL SPREADSHEET

excellent. In 1985 we produced Lightning, the pioneer and award winning Disk speed up software. In 1986 we developed the Breakthru 286 accelerator board that blew everything else out of the water, and later we topped ourselves with the Breakthru 12. Now in 1988 those who have worked with Lucid 3-D tell us "you have done it again. This is software everyone should have."

For a limited time

\$149

Lucid™
3-D

1-800-544-4699

Complete other spreadsheet s with a single key.

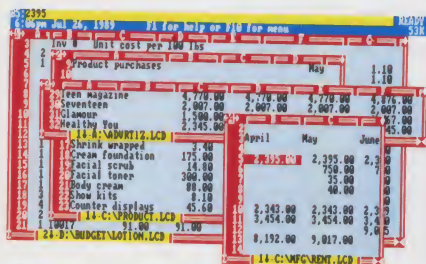


Fig. 5 Of course, Lucid does multiple windows. Notice, you can simultaneously open windows in different directories, different drives, even down as many 3-D levels as you like. No one else can do that.

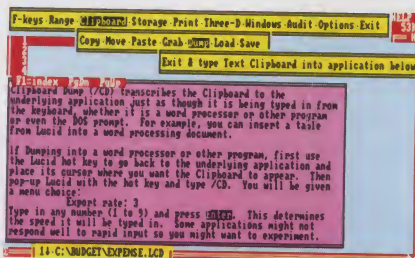


Fig. 6 We need those budget figures in the Word Perfect letter we are writing. Clipboard Dump does it right now.

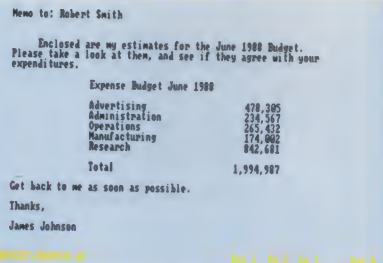


Fig. 7 Here it is right in Word Perfect (or any word processor) just like you typed it. You can go the other way just as easily.

you can make your custom menus work like Lucid where one choice can take you down a level to a whole new set of choices. What's nice is that they will work from one spreadsheet to another.

Mouseability

Lucid 3-D was designed for both keyboard enthusiasts and mouse lovers alike. You can take your pick. Designed around the mouse from the ground up, the interface is smooth and natural. You select files to load from directory lists. Everything is point and click. What's more, any Lucid 3-D menu selection can be "moused" and the response time is "right now" instead of the sluggish "a little bit behind you" feel of add-on mouse menu systems like those you've seen with 1-2-3.

A window pops up with a library of function names you can page through with the mouse. Select, click and it's in the formula with no typing required. You even have a label window that you can fill (from the keyboard) with favorite labels and names so that you can insert them later with the mouse. There's even a pop-up calculator to insert numbers so you don't have to go to the keyboard very often.

It really permits that feeling of becoming one with your work. Lucid

3-D has windows of user defined range names as well as the macros named by the user that can be selected just by pointing and clicking. Icons that are easy to grab with the mouse let you resize and move the spreadsheet window with the ease you would expect. Plus you can go anywhere on the sheet by moving the mouse and clicking on the spreadsheet borders. And remember, Lucid is designed so that any of those features are done with or without the mouse easily and quickly.

Audit

When you are staking a big decision on information gained from a spreadsheet you need to be certain that you have made no mistakes. Lucid 3-D offers five audit displays and printouts.

Even if you don't plan to abandon 1-2-3, Lucid makes sense. Files are converted between them with ease so there's not an interoffice compatibility problem. This means you can have the power and fun of Lucid 3-D without having to upset your present systems.

We are excited about Lucid 3-D. But don't take our word for it, take us up on our 60 day offer.

Call us on our order line number and we will ship your order the very next day. This \$149 offer will end as soon as our dealer network is fully stocked. But in the mean time we invite you to try Lucid as part of our "spread the news" campaign. Just pick up the phone and call us. We accept all major credit cards or you can order COD.

LucidTM

3-D

Ask your dealer or
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or 214-404-4000

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Any cell can contain a command that you can access

Aggregate expenses for all departments for July 1989:	
Advertising	152,394.00
Administrative	225,282.00
Operations	630,645.00
Manufacturing	632,591.00
Research and development	518,844.00
Total expenses	2,159,556.00

Fig. 1 Let's get the detail on those ad costs. Just move the widebar to that cell and press one key (Grey +).

Advertising July 1989	
Magazines	152,394.00
Newspapers	25,299.00
TV & Radio	152,394.00
Signwriting	97,654.00
Total	427,741.00

Fig. 2 Here we are, instantly. Notice the lower left corner showing we are on level 2. You can go down or up.

Advertising July 1989	
Magazines	152,394.00
Newspapers	25,299.00
TV & Radio	152,394.00
Signwriting	97,654.00
Total	427,741.00

Fig. 3 We want more detail, so let's go to News - papers. Just press the Grey + key.

Newspapers July 1989	
Washington Post	21,966.00
Dallas Morning News	14,886.00
New York Times	24,567.00
Chicago Tribune	17,654.00
Miami Herald	9,876.00
Los Angeles Times	11,950.00
Total	100,949.00

Fig. 4 Now, instantly we are on level 3. Each level is a different spreadsheet. You could now move to the New York Times and see the detail on that figure. There is no limit to the levels you can go. Move right down to transaction level if you like.

What Makes Lucid 3-D So Special
In the screen examples you can see Lucid is really three dimensional. Any cell of the spreadsheet can contain a complete other spreadsheet that you can access with a single keystroke. It is as simple as the pictures show. And you don't have to write formulas to do that.

All you do is go look at the other file, navigating through easy, point and shoot directories. When you come back up (with one key) the link is made automatically for you.

Everything about Lucid works that way. Users say "It is so intuitive that I really don't need a manual." That's because we use something we call a visual command menu. Jim Seymour, the noted PC columnist, talking about Lucid in a recent article said that, "If there ever was an interface idea so good it ought to be stolen and widely used, this is it."

What he was talking about is a new menu approach that follows a simple design concept: it is easier to recognize than it is to remember. As choices are made on a menu that take you to lower levels you always can see exactly where you came from and where you are going. The complete menu path is always visible. You cannot get lost several levels down. This means you never have to remember a command, you just flow right to it.

Plus, no matter where you are on a menu or what you are doing, just press function key F1, and you will get a help screen specific to that command or action. Or if you want to know about any subject you can pop up an index of over 600 topics and select the one you want.

Notepad Behind Every Cell

Another 3-D feature is that any cell can also contain a multiple page note that you instantly access with a single keystroke. You can write notes, memos or letters that relate to your work, save them as individual files and even print them separately or with your spreadsheet.

screen are completed. Other calculations you don't see continue on in the background during the next commands. The end result of this powerful combination is you rarely wait for a recalculation with Lucid. You find out what instantaneous is all about.

"I've been calling it an 'Everyman's Spreadsheet', and I think that's how the market will position it. It's much more than an inexpensive alternative to 1-2-3."

Jim Seymour, Columnist, PC Magazine, PC Week

Speed

Lucid 3-D is truly revolutionary. It is fast, fast, fast! It is incredibly quick in performing calculations because it doesn't recalculate every cell every time you insert an entry. Instead, it only recalculates the specific cells that are affected by your change. This is called minimal recalc. Lucid also has a remarkable innovation called background recalc in which you are given control of the cursor the moment calculations affecting your viewing

Lucid Learns

Lucid 3-D also lets you teach it in any combinations of keystrokes so that involved sequences can be done with single keys. Plus more than just remembering keystrokes, Lucid allows you to create Macros with loops, procedures and conditional branching amazingly all done automatically with simple menus. You can create your own menus that show the new features you have taught it. Another great feature is

LucidTM

3-D

ADVER.LCD, D13
10:49AM May 26, 1989
F1 for help or F10 for menu

Aggregate expenses for all departments for July 1989:

Advertising	\$236,382.00
Administrative	\$307,645.00
Operations	\$632,591.00
Manufacturing	\$158,044.00
Research and development	\$1,656,191.00
Total expenses	\$3,590,853.00

1-C:\BUDGET\EXPENSE.LCD



ADVER.LCD, D13
10:49AM May 26, 1989
F1 for help or F10 for menu

Inc Magazine	\$1,124.00
Business Week	\$1,124.00
Money Magazine	\$1,124.00
Entrepreneur	\$1,124.00
Forbes	\$1,124.00
Total	\$5,620.00

1-C:\BUDGET\ADVER.LCD

ADVER.LCD, D13
10:49AM May 26, 1989
F1 for help or F10 for menu

Advertising
Magazines
Newspapers
TV & Radio
Skywriting
Total

July 1989	\$23,999.00
Aug 1989	\$23,875.00
Sep 1989	\$45,260.00
Total	\$93,134.00

2-C:\BUDGET\ADVER.LCD

ADVER.LCD, D13
10:49AM May 26, 1989
F1 for help or F10 for menu

Item	Qty	Unit Price	Total Price
1 year sub rate	1	\$3,000.00	\$3,000.00
1 year sub rate	1	\$3,000.00	\$3,000.00
Total	2	\$3,000.00	\$6,000.00

Actual cost per issue with special deal



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